

Research Report 1398

AD-A162 841

# Analysis of Training Requirements for the Basic Noncommissioned Officer Course for M1 Tank Commanders (19K BNCOC)

Eugene H. Drucker, David L. Hannaman,  
William H. Melching, and Richard E. O'Brien  
Human Resources Research Organization

Fort Knox Field Unit  
Training Research Laboratory



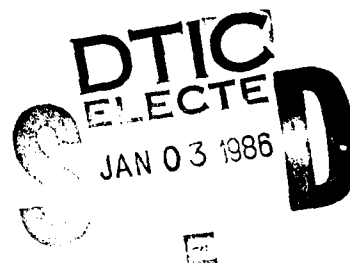
U. S. Army

Research Institute for the Behavioral and Social Sciences

February 1985

Approved for public release; distribution unlimited.

6 2 073



**A Field Operating Agency under the Jurisdiction of the  
Deputy Chief of Staff for Personnel**

**L. NEALE COSBY**  
Colonel, IN  
Commander

Donald M. Kristiansen  
Ronald Spangenberg (TRADOC-TTA)

Accession For

GFA&I

TRE

SEARCHED

SERIALIZED

INDEXED

FILED

JUN 1967

FBI - NEW YORK

QUALITY INSPECTED  
1

A-1

NOTE: The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

ARI Research Report 1398

20. (Continued)

→ interactive tasks performed by tank commanders were also identified. The training devices, aids, and materials that will be available for use in 19K BNCOC for training tank commanders within the next three years were identified along with those that will be available in units for use by tank commanders to train their crews. The impact of new training systems and technologies on 19K training developers, instructors, and students was discussed along with the need for instructional computer literacy.

Keywords:

2)

UNCLASSIFIED

ii SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

Research Report 1398

# Analysis of Training Requirements for the Basic Noncommissioned Officer Course for M1 Tank Commanders (19K BNCOB)

Eugene H. Drucker, David L. Hannaman,  
William H. Melching, and Richard E. O'Brien  
Human Resources Research Organization

Billy L. Burnside, Contracting Officer's Representative

Submitted by  
Donald M. Kristiansen, Acting Chief  
ARI Field Unit at Fort Knox, Kentucky

Approved as technically adequate  
and submitted for publication by  
Donald F. Haggard, Acting Director  
Training Research Laboratory

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES  
5001 Eisenhower Avenue, Alexandria, Virginia 22333

Office, Deputy Chief of Staff for Personnel  
Department of the Army

February 1985

---

Army Project Number  
2Q263743A794

Education and Training

Approved for public release; distribution unlimited.

ARI Research Reports and Technical Reports are intended for sponsors of R&D tasks and for other research and military agencies. Any findings ready for implementation at the time of publication are presented in the last part of the Brief. Upon completion of a major phase of the task, formal recommendations for official action normally are conveyed to appropriate military agencies by briefing or Disposition Form.

---

## FOREWORD

---

The ARI Fort Knox Field Unit has been involved for approximately ten years in the development of innovative approaches to training for the Armor community and the Army as a whole. During the past year, this effort has been given special emphasis through formation of the Training Technology Field Activity (TTFA), a partnership among ARI, Training and Doctrine Command, and the US Army Armor Center and School. The purpose of the TTFA is to increase the effectiveness and efficiency of training through the application of appropriate new technologies.

Initial efforts of the Fort Knox TTFA are being concentrated upon the institutional program for training M1 tank commanders. Before introducing new technologies into their training program, it is necessary to insure that the appropriate groundwork has been accomplished, in terms of analysis, design, and development. The present report presents the results of the first phase of this process by providing a review and supplement of available job and task analysis for the M1 tank commander duty position. Future reports will address design and development of the technology-based training program.

This report is divided into two parts. The first part addresses primarily additional tasks that should be considered for training in the program. The second part addresses primarily technologies that should be considered for implementation. Both parts should be useful to training developers and managers in the Armor community and throughout the Army training system.



EDGAR M. JOHNSON  
Technical Director

ANALYSIS OF TRAINING REQUIREMENTS FOR THE BASIC  
NONCOMMISSIONED OFFICER COURSE FOR M1 TANK COMMANDERS (19K BNCOC)

EXECUTIVE SUMMARY

**Requirement:**

The US Army Research Institute for the Behavioral and Social Sciences (ARI), the US Army Training and Doctrine Command (TRADOC), and the US Army Armor Center and School (USAARMC) have established a Training Technology Field Activity (TTFA) at Fort Knox to incorporate the products of training technology into the Basic Noncommissioned Officer Course for M1 tank commanders (19K BNCOC). The purpose of the TTFA is to facilitate the coordination between specialists in technology, training development, and training in the design, development, and implementation of military training. The first course which ARI, TRADOC, and USAARMC are jointly developing is 19K BNCOC, and the first step in this effort is the requirement to conduct an analysis of the 19K duty position in order to identify which tasks should be trained in the course.

**Procedure:**

The Systems Approach to Training was used to supplement the inventory of critical 19K30 (M1 tank commander) tasks that had been developed earlier by the Directorate of Training and Doctrine. Documents pertaining to armor operations and the training of armor-related skills were examined, and interviews were conducted with subject-matter experts. In addition to supplementing the tasks that were identified during the initial front-end analysis of the 19K duty position, non-procedural tasks performed by tank commanders were also identified. These were decision making, problem solving, and interactive tasks which are not the traditional focus of a front-end analysis. Training devices, aids, and materials available for BNCOC and for tank commanders to use in units for training their crews were also identified. In addition, a review was conducted of the training systems and technologies that will be available for 19K training in BNCOC and in units within the next three years.

**Findings:**

A total of 16 critical tasks not currently trained in 19K BNCOC were recommended for inclusion in the course. Eleven of these tasks are in the current 19K task inventory, but they are not classified as 3X tasks (i.e., skill level 3 tasks designated for institutional training). The five remaining tasks are not in the current 19K task inventory. In addition, the recommendation was made that three of the tasks currently trained in BNCOC be modified and that three tasks be deleted from BNCOC.



The recommendation was also made that several tasks being trained in BNCOC, but which are not classified as 3X tasks, be reclassified. In addition, decision making, problem solving, and interactive tasks performed by tank commanders during combat were identified. The training devices, aids, and materials that will be available for use in BNCOC for training tank commanders within the next three years were identified along with the devices, aids, and materials that will be available for tank commanders to use in units to train their crews. Finally, the impact of new training systems and technologies on 19K training developers, instructors, and students was ascertained, and the need for instructional computer literacy was discussed.

#### Utilization:

The results of this analysis of the 19K duty position will be used to modify the design of 19K BNCOC so that the course includes critical tasks that have been identified during this project and incorporates the products and procedures of current technology.

ANALYSIS OF TRAINING REQUIREMENTS FOR THE BASIC  
NONCOMMISSIONED OFFICER COURSE FOR M1 TANK COMMANDERS (19K BNCOC)

CONTENTS

	Page
PART I: REVIEW OF ANALYSIS PHASE ACTIVITIES . . . . .	1
Introduction . . . . .	1
Background . . . . .	2
Focus of Present Report . . . . .	3
Activities Undertaken . . . . .	7
Findings . . . . .	11
Recommendations and Conclusions . . . . .	18
Summary . . . . .	56
PART II: TRAINING SYSTEMS AND TECHNOLOGY CONSIDERATIONS . . . . .	58
Background . . . . .	58
Objective . . . . .	58
Approach . . . . .	59
Findings . . . . .	62
Summary . . . . .	81
REFERENCES . . . . .	84

LIST OF TABLES

Table 1. Decision Making Tasks Performed By Tank Commanders and the Factors That Are Considered When Performing These Tasks . . . . .	25
2. Problem Solving Tasks Performed By Tank Commanders During Combat . . . . .	33
3. Interactive Tasks Performed By Tank Commanders During Combat . . . . .	41
4. Skill Level 1 and 2 Tasks Tank Commanders Must Be Prepared To Train . . . . .	46
5. Training Devices, Aids, and Materials Applicable To 19K10-30 Task Clusters . . . . .	48
6. 19K10-20 Tasks That Are Prerequisites for 19K30 Tasks Taught in BNCOC Or Recommended for BNCOC . . . . .	54

	Page
7. 19K10-20 Tasks That Are Prerequisites When the Tank Commander Is Role Playing As Gunner, Loader, Or Driver During BNCOC . . . . .	55
8. Applicability of Training Systems To 19K BNCOC Task Clusters . . . . .	73

ANALYSIS OF TRAINING REQUIREMENTS FOR THE BASIC  
NONCOMMISSIONED OFFICER COURSE FOR M1 TANK COMMANDERS (19K BNCOC)

PART I: REVIEW OF ANALYSIS PHASE ACTIVITIES

Introduction

Consistent with recommendations of the Defense Science Board 1982 Summer Study on Training and Training Technology, the Secretary of Defense has recently directed the Military Departments to increase their funding and management emphasis on research and development of training technology, and to explore the application and payoff of this technology. Specific recommended actions included activities such as accelerated use of computer-based instructional methods via portable aids and/or embedded training systems, increased exploration and use of current and advanced technology devices (e.g., arcade-like games) to motivate and teach fundamental skills, and increased development and use of emerging technologies (voice recognition, interactive displays, personal job aids, etc.).

To facilitate an examination of the new technology, the Army established a special Training Technology Field Activity (TTFA) at Fort Knox. Elements of the US Army Training and Doctrine Command (TRADOC), the US Army Research Institute for the Behavioral and Social Sciences (ARI), and the US Army Armor Center and School (USAARMC), working in concert, were designated as managers of the TTFA. The Fort Knox TTFA has the mission of improving the effectiveness and efficiency of Army training through the testing and application of training technology, with technology broadly defined as including techniques, strategies, methods, models, hardware, and software.

Under contract with ARI, HumRRO was requested to perform work for the TTFA. The TTFA elected to explore application of the new technology by determining how it might be applied in a specific course, the 19K BNCOC. This is a course designed to train tank commanders for the M1 tank. Interest in the use of the technology, as an aid to training, focused on both the BNCOC instructor as he trained BNCOC students, and on the BNCOC student when he later became a tank commander and was charged with training his crew.

A first requirement was to confirm and update the training needs of the BNCOC student (MOS 19K30). Since the duty position was analyzed prior to the existence of the position, it was necessary to examine the results of the initial analysis. Of particular concern was the identification of new critical tasks. In this regard, interactive, problem solving, and decision making tasks were of greatest interest. Also at the forefront were new non-critical tasks that the 19K30 might need to perform if he were to employ the technology in BNCOC or in units for training his crew.

An accepted procedure for guiding the development or revision of a training program is to follow the systems approach to training. This concept is described in TRADOC Reg 350-7 (1982), A Systems Approach to Training (SAT). Accordingly, the procedures recommended in this document were followed in undertaking the assessment of the 19K BNCOC. Since the analysis was intended to supplement the initial analysis, it was uncertain whether SAT procedures could be applied. Since other TTFAs would be started, and other MOSs would be analyzed, a secondary purpose was to adapt SAT procedures for supplementary analysis.

### Background

TRADOC Regulation 350-7, A Systems Approach to Training, describes the approach that is to be followed when developing Army training programs. The approach involves five phases which interact in non-linear fashion--evaluation, analysis, design, development, and implementation. The approach requires that training be based on objectives that are linked to the behaviors required of soldiers in a specified duty position. Based on the Instructional System Development (ISD) model, the phases of training development are viewed as interdependent with continuous evaluation of the system during the developmental efforts. During the analysis phase, an intensive description of the duty position is prepared. More specifically, a task inventory is prepared, tasks that are critical to the mission are identified, task performance specifications and/or task performance measures are prepared, and training sites are recommended. During the design phase, the basis for the subsequent training program is developed. That is, the results of the analysis phase are used to prepare terminal training objectives, the skills and knowledges necessary to achieve these objectives are established, the training sequence is devised, and the training sites are confirmed or revised. During the development phase, the results of the design phase are used to prepare both the training program and the training support materials that are needed to implement the program. Training methods will be selected, training materials will be selected, new materials will be developed (if necessary), the training materials will be validated, school and staff training needs will be identified, and a training management plan will be prepared. During the implementation phase, final preparations for training are made and training is implemented. Data are collected to validate and evaluate the program. During the evaluation phase, which overlaps all other phases, formal and informal feedback are obtained to determine the need to make changes within the system.

Although TRADOC Reg 350-7 requires that training development follow the SAT approach, numerous difficulties have been observed in attempts to implement the policy (Vineberg & Joyner, 1979). Training development agencies often do not have the time or the resources to follow the comprehensive approach required by TRADOC. Moreover, the requirements are often stated in general rather than specific terms, giving training developers wide leeway in preparing training programs. Detailed guidance is not contained in any single document and training developers must coordinate guidance from various sources. Consequently, the

intended procedures for training development have not consistently been followed.

Training developers have an additional problem that has been created by the rapid pace at which technological change is occurring. Training devices involving high technology have recently been introduced (e.g., U-COFT), while others are likely to be introduced within the next several years (e.g., I-COFT, videodisc trainers). Although training developers are responsible for recommending training devices for the programs which they develop, the complexity of evolving devices and technologies makes it difficult for training developers to keep pace with the capabilities of these devices and their methods of utilization. The problem is not limited to training developers, however. Soldiers in certain job positions, such as tank commanders, are required to conduct training as an integral part of their job. Consequently, they must be trained to know the capabilities of these devices and know how to use them. Since the operation of these devices is not a critical task essential for combat success and survival, they are not in the task inventory. Consequently, little, if any, training is provided on the devices and their use during training. Thus, there is not only a need for the training developers to obtain an improved awareness of the training devices that result from the new technology, but also for soldiers who conduct training to learn how to use them.

#### Focus of Present Report

The present report will be focused solely on the analysis phase of the SAT. Subsequent reports will deal with the other phases of interest (design and development).

Results of the analysis phase will be described under three main sections--Activities Undertaken, Findings, and Recommendations and Conclusions. Detailed descriptions of activities and findings will be reported, and as appropriate, the rationale or justification underlying each recommendation will also be provided.

The major goal of this phase centered on insuring that all tasks appropriate for training in 19K BNCOC were identified. Interpretations that served to guide the effort are given below.

#### Types of Tasks

An essential requirement of the Systems Approach to Training is that the tasks selected for training be essential for mission accomplishment and individual survival on the battlefield. Tasks that meet this criterion are referred to as critical tasks, and the methods for determining task criticality are described in TRADOC Pamphlets 310-8, Collective Front-End Analysis for Development of the Army Training and Evaluation Program (ARTEP) and A Method for the Development of Drills, and 351-4, Job and Task Analysis Handbook. Most critical tasks

contained in the task list for the 19K duty position are procedural in nature. That is, they are performed in a specific sequence of steps that can be readily trained and practiced. Many critical tasks however are highly non-procedural. That is, they are not performed in a fixed sequence of steps and their performance is highly dependent upon the situation in which they are performed. The fact that they are non-procedural, however, does not imply that they do not affect the outcome of a mission or individual survival on the battlefield.

The analysis of the tasks performed in the combat arms has traditionally focused on procedural rather than non-procedural tasks. Consequently, many of the critical duties of tank commanders do not appear in the 19K10-40 task list and therefore they may not be sufficiently emphasized in training. Included among these are decision making, problem solving, and interactive tasks performed in combat. This is not meant to imply that these non-procedural tasks are not taught at all. Many of the skills involved in these tasks are in fact currently being taught, but they are often subsumed under other critical tasks as either subtasks or steps or are assumed to be supporting knowledges and skills that are required to perform the tasks. Consequently, the emphasis placed upon these tasks may not reflect their actual criticality in combat. One of the major goals of this project is to identify these tasks and to prepare a design for 19K BNCOC that would include them and provide an emphasis corresponding to their true importance.

Although the Systems Approach to Training emphasizes that the tasks selected for training must be critical, there are certain non-critical tasks that are nevertheless very important for efficient functioning of military personnel. These are tasks that are part of training itself. When a tank commander participates in 19K BNCOC, he must be able to operate certain training devices and training aids such as the Beseler Cue/See or MILES. While the operation of neither of these two devices is critical for the accomplishment of the mission or for individual survival, it may be instrumental in determining how well critical tasks can be learned. Consequently the criticality of these tasks belies their actual importance. Similarly, when the tank commander is assigned to a unit, he is responsible for training his crew. In order to perform this function effectively, he must be aware of the training devices, aids, and materials that are available to him, and equally important, he must be able to use them. With the development of new training devices and aids that are becoming increasingly sophisticated technologically, the skills and knowledges required for their operation are inevitably going to increase. Therefore, it is one of the goals of this project to identify non-critical 19K tasks that are instrumental in the performance of critical tank commander tasks and to prepare a design for 19K BNCOC that would include them.

The search for additional tasks, both critical and non-critical, can be meaningfully characterized by describing the types of tasks being sought. At the outset, ARI encouraged the research team to search for interactive, problem solving, and decision making tasks. In addition, much interest was expressed in identifying tasks that might need to be

trained as a result of increased use of new training technology. These classes of tasks are described below.

A common observation made by senior NCOs and officers about a new tank commander (TC) when he first participates in a tactical exercise is that the TC doesn't know what to do. He may have performed well in gunnery, but now that he must coordinate the actions of his tank with other tanks, he is at a loss. For example, he may be unable to acquire targets, to maintain the proper position of his tank with respect to others, or to know when to engage a target. In addition, in his new role as TC, he must interact and coordinate with persons outside the immediate crew. He must be able to respond quickly and correctly to requests, directions, and orders from his platoon sergeant and platoon leader. Similarly, in many situations he must initiate communication and coordination with his superiors. For example, he may need to pass on or receive vital information about targets, supplies, casualties, maintenance, etc.

In situations in which the actions required of the TC are simple or straightforward, there is generally little chance for confusion and misunderstanding. The TC may have much relevant experience to support him, and he may readily behave as required. Other situations, however, may be not only complex but also unexpected and severe in their possible outcomes. If a clear-cut response is not available, the TC may be at a loss as to what he should do.

### Critical Tasks

Interactive Tasks. In performing his job, the TC must coordinate the actions of his tank with one or more other vehicles. He must also communicate with persons other than his immediate crew. When he coordinates his actions or communicates with these "outside" persons, he can be said to be interacting with them. This interaction necessarily involves overt actions or steps by at least two tanks or two persons. Thus, it is appropriate to describe these actions as interactive tasks.

In his earlier experience as a crewmember, the TC generally interacted exclusively with other crewmembers. When he becomes a TC, therefore, he will have had little if any opportunity to practice interacting with other tanks or other persons (platoon leader, platoon sergeant, other tank commanders, etc.). Thus, identification of important interactive tasks will enable the TC to undertake gainful practice on such tasks.

Decision Making Tasks. The TC can be said to engage in decision making behavior when he is confronted with a situation in which alternative responses are possible, and he must decide which response is most appropriate. This decision making behavior, which for convenience can simply be called "decisions," can occur in a multitude of circumstances. They can be quite simple and seemingly innocuous (At what time should I eat?) or complex and potentially dangerous (Which target should I engage now?). In both of these situations the TC may seek relevant information, recall guiding principles, consider possible effects of



each alternative, etc., and then decide. Decisions are often made in minutes or seconds, depending on the urgency of the situation. Viewed this way, the TC must make numerous decisions when on the battlefield. He can become a more effective TC if the more important of these decisions are identified, and he is given training directed specifically at learning how to make them.

Problem Solving Tasks. While decision making involves the selection of an appropriate action, problem solving pertains to the subjective analysis of factors involved in decision making. For example, the determination of whether or not to fire at an enemy target is a decision since it involves a choice between two actions--firing at the target or not firing at the target. (In the case of deciding whether or not to perform an action, not performing the action is considered to be an alternative action.) There are several factors which must be considered when making the decision including the distance to the target and need to keep the presence of the friendly force hidden from the enemy. The first of these two factors, distance to the target, is normally not a problem since distance can be measured accurately using the laser range finder. The second factor, need to keep the presence of the friendly force hidden from the enemy, is a problem since it is primarily subjective. That is, while there is likely to be no disagreement between decision makers on the range to an enemy target, there may be disagreement on the importance of keeping the friendly force hidden. Moreover, even if there is total agreement on the latter, the judgment itself may be wrong (e.g., the enemy may already be aware of the presence of the friendly force).

Since subjective factors have a major effect on combat decisions, and since decisions made in combat can affect the successful accomplishment of the mission, it is important to assure that tank commanders are capable of solving the types of problems that occur during combat. Assurance that they can perform these tasks requires that they be adequately trained. But before they can be trained to solve combat problems, the problems themselves must first be identified. It is one of the purposes of this phase of the project, therefore, to identify these problems so that appropriate training can be designed and developed later in the project for possible adoption in 19K BNCOC.

#### Non-Critical Tasks

There will be two groups of tasks falling in this category. First will be those tasks that are instrumental in learning critical tasks that are taught in BNCOC. Second will be the tasks that the 19K30 student may have to perform later when he becomes a tank commander and must train his crew. In this capacity he may be required to employ various new training technology devices. Thus, to the extent possible at this time, the tasks that the 19K30 must perform as he employs the new technology or devices will be cited.

## Leadership

It should be noted that the performance of decision making, problem solving, and interactive tasks comprises the major elements of tactical leadership. While leadership training at the NCO level generally focuses on such duties as counseling and receiving and orienting newly assigned crewmen, tank commanders are not only responsible for the operation of an extremely costly piece of military equipment, they also play a major role in determining the success of their unit mission. Unfortunately, the traditional approach to the training of leadership at this level has resulted in relatively little emphasis being placed on problem solving and decision making. Similarly, there has been too little emphasis on training the tank commander to coordinate his activities with elements external to the tank. The recent emphasis on the wingman concept, however, illustrates the importance of interactive tasks during combat. By identifying the problem solving, decision making, and interactive tasks performed by tank commanders, and by implementing the most critical of these tasks in 19K BNCOC, a major step will be taken toward improving the leadership quality of M1 tank commanders.

## Activities Undertaken

In undertaking the effort to update the 19K BNCOC program, a first requirement was to establish BNCOC training needs. To determine these needs, it was planned to employ the Systems Approach to Training (SAT) as set forth in TRADOC Reg 350-7. The SAT describes, in generic terms, the actions that must be undertaken to insure the systematic production of training and training support materials. As it has evolved, the SAT may be used to direct the development of an entirely new training program or to aid in the planned revision of an existing program. In each case, the steps remain essentially the same.

It should be emphasized that, since the 19K BNCOC program had only recently been developed by the Directorate of Training and Doctrine at the Armor School at Fort Knox following SAT procedures, application of the SAT process to the program by the research staff actually constituted a re-application of the process. In other words, while the initial development of the 19K BNCOC program began with only some 19E BNCOC data as background, the subsequent SAT effort by the research staff had available the actual products of the earlier SAT application.

Activities undertaken during the analysis phase can be viewed as falling into several clusters. The specific activities that comprised each cluster are described in detail below. Additional activities that were undertaken to obtain information about anticipated computer-based training systems and technologies that might have particular relevance to the 19K BNCOC program are described in Part II of this report.

## Review of Documents

The overall goal of the analysis phase was the identification of all critical tasks to be performed by the 19K30. The identification of new critical tasks that involve decision making, problem solving, or interaction was of special interest. In addition, noncritical tasks that involve high training technology were also to be identified. Several documents were examined in an effort to obtain the needed information. These included: (a) the latest available task inventory for MOS 19K10-40, (b) Soldier's Manuals for 19K10-40 (common tasks and armor-specific and M1-specific tasks), (c) program of instruction for 19K BNCOC, and (d) current training schedule for 19K BNCOC.

When the SAT is used to generate a new training program, the documents listed above will be produced for the first time. In contrast, when the goal is to examine a program for possible revision, the analyst can begin by examining existing documents. This was done in the present case.

Task Inventory for MOS 19K10-40. Prior to the development of the present 19K BNCOC, a task inventory of MOS 19K10-40 was prepared by the Individual Training Division (ITD) of the Directorate of Training and Doctrine (DOTD) at the Armor School in Fort Knox. It contained a list of the tasks performed by M1 armor crewmen, including common tasks performed by all soldiers in the combat arms and specific tasks that are performed only by tank crewmen in the 19K duty position. The inventory provided the task number, skill level of the crewman performing the task (i.e., 1, 2, 3, or 4), and recommended site for training the task (resident training--X, extension training--Y, or not selected for training--Z). The task inventory was the means by which the ITD informed design and development personnel of the tasks it recommended for inclusion in 19K BNCOC.

This task inventory was examined in detail by the research staff, and preliminary opinions were formed on the basis of our experience in armor operations about tasks that might be added, dropped, modified, etc. The existing task inventory was also reviewed by the research staff and judgments made about skill level 1 and 2 tasks that the 19K BNCOC graduate would be required to train once he became a tank commander. These judgments were grounded in the results of earlier research on mission-based analyses of armor requirements, discussions with in-house armor experts, and reviews of various documents dealing with armor crew tasks (especially tank commander tasks).

Soldier's Manuals (SM). Several SM are relevant to the training of MOS 19K30. Some SM deal with common tasks at the various skill levels, and some focus only on tasks specific to the M1 armor crewman. These SM are important for at least two reasons: (a) They not only list tasks that the 19K30 tank commander must perform but also the tasks that his crewmen must learn, i.e., tasks that the TC must train his men to perform; and (b) They contain conditions, standards, and performance measures for each task. The latter can be useful in judging matters such as amount of training time needed, probable site of training, etc.

The research staff reviewed relevant tasks in the several SM and sought to identify tasks that, although not in the current 19K30 task list, could be viewed, in their opinion, as potential candidates for inclusion in BNCOC. Similarly an effort was made to identify tasks that could become candidates for exclusion from the BNCOC. Some effort was spent in reviewing and judging the relevance of common tasks to armor training. In this activity particular attention was paid to the specific conditions under which tasks had to be performed. A basic concern in the review can be captured by the question, "Is this task feasible to perform by an armor crewman in the way it is presently described?" For example, skills needed to navigate from point A to point B while on foot may be quite different from those needed when navigating while in a moving vehicle.

Program of Instruction (POI). The POI for 19K BNCOC was prepared by the Course Development Division of DOTD. It contains the training objectives for each task to be taught in BNCOC as well as the recommended type of instruction and length of instruction.

Since tasks performed by tank commanders are classified as skill level 3 (SL 3) tasks, the tasks listed in the POI were compared with the SL3 tasks listed in the task inventory to highlight differences. Tasks in the POI that were not SL3 tasks were noted in anticipation of the time when differences could be discussed with interested personnel from DOTD.

Training Schedule. The BNCOC training schedule, which was prepared by personnel from the NCO Academy, lists tasks in the sequence in which they will be trained. In addition, it provides basic information such as hours of class meetings, locations of classes, source of instructors, uniform, etc.

The research staff reviewed the schedule and compared the tasks listed on it with the tasks as cited in the POI and in the 19K10-40 task inventory. Differences among the documents were noted in anticipation of an opportunity to clarify them with DOTD personnel.

Related Documents. Several other documents were examined to obtain useful leads about possible additional critical tasks. A list of these documents and the focus or purpose for reviewing each are given below.

<u>Document</u>	<u>Focus</u>
FM 17-12-1 (Draft), Tank Gunnery M1 (Oct 82)	Identify TC actions during tank gunnery.
ARTEP 71-2, Army Training and Evaluation Program for Mechanized Infantry/Tank Task Force (Nov 81)	Identify the individual tasks on which the unit will be evaluated.
TT 71-1/2, The Abrams Battalion, Division 86 (Mar 82)	Identify TC actions during different platoon and company actions.

Mission-Based Analysis of  
Armor Training Requirements,  
HumRRO Final Report FR-MTRD(KY)-  
81-2 (Feb 81)

Identify TC tasks performed during  
missions and identify possible  
interactive tasks for the TC.

Critical Incidents as Reported  
by Veterans of Armored Combat,  
HumRRO Final Report (June 75)

Identify possible interactive tasks  
performed by TC.

FM 17-15 (Test), The Division 86  
Tank Platoon (Apr 83) and  
TC 17-15-1 (Draft), Division 86  
Tank Platoon Mission Training  
Plan (Jun 83)

Examine mission scenarios to  
identify actions of TC.

FM 17-12-7 (Draft), Tank Gunnery  
Devices (Feb 84) and 1980  
Catalogue: Training Aid Devices  
and Graphics (Feb 83)

Determine which crewman tasks could  
be trained on devices and which  
devices could be used in BNCOC.

#### Conduct of Interviews

Interviews were conducted with selected armor personnel. The general purpose of interviews with analysis, design, and development personnel was to determine how the MOS 19K and BNCOC documents were developed, i.e., the rationale that guided task selection and the specific procedures that were used in implementing the rationale. Related purposes guided the conduct of interviews with other personnel. The following paragraphs list who was interviewed, indicate number of persons interviewed, and give the specific purpose of each interview.

Analysts, Individual Training Analysis Branch, ITD, DOTD. Two analysts who prepared the task inventory for MOS 19K10-40 were interviewed to obtain detailed information on procedures that they used. This included how they identified tasks for inclusion in training, how skill levels were determined, how training sites were selected, what reasons were used for rejecting tasks for training, and what procedures were used by the task selection board to select tasks. Also sought was information on the types of problems that personnel experienced as they attempted to follow the recommended SAT procedures. Finally, opinions about tasks that should be added to or dropped from the current 19K BNCOC were sought.

Chief, Individual Training Manual Branch, ITD, DOTD. This interview sought to determine how tasks were selected for inclusion in the SM, relationship of the SM to the task inventory, and the specific purpose of the SM.

Chief, Course Development Division, DOTD. While the POI for BNCOC was prepared during the development phase of the SAT, the interview set out to determine how tasks were chosen for the BNCOC and to account for differences between the POI and the task inventory. Opinions about tasks to add to or drop from BNCOC were requested.

19K BNCOC Instructors. In this interview with two 19K BNCOC instructors, an attempt was made to confirm that tasks listed in the POI agreed with tasks contained on the training schedule. Their opinions about tasks that should be added to or dropped from BNCOC, or BNCOC tasks that should be modified in some way, were also sought.

Master Gunner and ANCOC Students. Interviews were conducted with 12 persons to obtain their opinions about TC tasks that are hard for TCs to learn, plus to get their suggestions about tasks that should be added or dropped from BNCOC. Their opinions were also sought about new tasks that the research staff proposed as candidates to add to BNCOC.

Various SME in Armor School. Some eight persons in the Armor School who were acknowledged experts in selected subject matter areas (e.g., land navigation, communications, NBC, leadership, etc.) were interviewed to obtain their opinions about tasks that should be added to or dropped from BNCOC.

### Findings

One goal during the review of analysis phase activities centered on understanding the procedures that were used to derive the tasks that were selected for training BNCOC. Problems that were experienced by personnel in deriving tasks and in employing the SAT were also of interest. Finally, the identification of new tasks was of overriding concern. Findings from the several activities are reported in the following sections.

#### Derivation of Present 19K BNCOC Tasks

The Individual Training Division (ITD) began the derivation process by first constructing a task list (common tasks plus armor specific tasks) for all of MOS 19K10-40. Since the only difference in tasks between MOS 19E and MOS 19K was assumed to be due to hardware (M60 vs. M1), a fertile source of information about 19K tasks was the current 19E task list. To this list analysts added or deleted tasks based on engineering knowledge about the different tanks. This enabled the development of a preliminary task list for 19K10-40. This task list was submitted to approximately 30 personnel who were conducting an operational test of the prototype vehicle, and they were asked to rate the tasks according to their criticality (e.g., frequency of performance, percent performing, time to learn, etc.). From their responses, a revised list of critical tasks was developed.

Refinement of the list continued as relevant documents and task analysis information became available. A Working Board in ITD recommended skill level (1, 2, 3, or 4) and training site (resident training--X, nonresident training--Y, or not scheduled for training--Z) for each task and then submitted the list to a Formal Board. The latter made final decisions about skill level and training site, and these

decisions guided ITD in designating the tasks it recommended for inclusion in BNCOC. Specifically, all skill level 3 tasks in the list that were also marked for resident training were recommended by ITD for inclusion in BNCOC.

While the SAT guidance indicates that the selection of tasks for training is to be accomplished in the analysis phase, the selection process for 19K BNCOC was actually continued during the design phase. Persons charged with the design of the course did not feel bound to the task list provided by ITD, and they modified it in ways in which, in their opinion, the course would be improved.

The ITD task list for M1 armor crewmen, dated September 1983, contained 48 tasks that were coded as SL3X.<sup>1</sup> By contrast, the 19K BNCOC POI, prepared by design personnel for the initial course, contained 56 tasks. Examination of the two documents revealed that two tasks were deleted from the ITD task list, and ten tasks were added to the original ITD task list. Of the ten added tasks, two were SL1X, one was SL2Y, five were SL3Y, and two were SL4X. The specifics are stated below.

<u>Task List Code</u>	<u>Tasks Deleted From ITD Task List</u>
3X	Establish Silent Watch
3X	Prepare TC Weapon for Travel
<u>Tasks Added To The POI</u>	
1X	Boresight & System Calibrate the M1 Tank
1X	Determine Directions Using Field Expedient Methods
2Y	Use the Automated CEOI
3Y	Install & Operate Hot Loop Wire Communications
3Y	Prepare for NBC Attack
3Y	Conduct Performance Counseling With a Subordinate
3Y	Analyze Terrain Using 5 Military Aspects of Terrain
3Y	Engage Targets With M240 Coax
4X	Prepare and Issue Oral Operations Order
4X	Direct Consolidation & Reorganization on Objective

---

<sup>1</sup>It should be noted that the task inventory (as well as POI, SM and training schedule) may undergo frequent "unscheduled" modifications. Furthermore, changes may be implemented in one document but not in the companion ones. For example, the way a task is performed in the field may change. However, notice of this change may reach one of the document sources but not the others. Thus, the sources tend to be out of synchronization at almost any point in time.

### Problems Encountered in Applying SAT

In its efforts to develop a valid task list, the ITD submitted questionnaires to personnel who were engaged in operational tests of early versions of the M1. These questionnaires sought to obtain information about frequency and criticality of performance on specific tasks. Unfortunately, according to ITD, responses of these persons to the ITD questionnaires were suspect. For example, in one instance respondents showed little or no variation in evaluating the criticality of tasks even though the nature of the tasks varied widely. In another instance, respondents rated tasks in ways that could only be described as illogical. It was ITD's opinion that the raters behaved in these ways because they had been surveyed so many times previously by other agencies for similar purposes. In other words, raters had been overloaded with requirements to do surveys and they expressed how they felt by responding only superficially to the ITD questionnaire.

Getting good feedback from the field about postulated tasks when new hardware is being developed presents two main stumbling blocks. Since the hardware is new, a supply of persons having experience with the hardware is necessarily non-existent. Persons who have been engaged in conducting operational tests with the hardware or prototype versions of the hardware are the only ones whose experience is related to the job of interest. In summary then, job incumbents do not exist, and persons whose experience, at best, only approximates the incumbent are few in number. In light of this it is not surprising to learn that good survey data are hard to obtain.

Actually, persons involved in operational tests are likely to be no more able to judge matters such as "time for a new trainee to learn a task," "percent of soldiers performing a task," or "how often a task is performed" than are persons who have produced the initial task inventory. While soldiers who are participating in operational tests on a new vehicle must learn to perform the tasks unique to the new vehicle, these soldiers have the benefit of their previous experience and only need to learn the transition from one vehicle to another. They are therefore not uniquely qualified to judge how difficult it would be for untrained soldiers to learn to perform the tasks. Furthermore, since they would have had no previous experience in units performing the tasks unique to the new vehicle, they would not be in a position to estimate the percentage of soldiers who would perform each task or how often the task would be performed. On the other hand, criticality data for tasks that are not specific to the vehicle would already exist, and would not need to be collected during an operational test. In short, when job incumbents do not exist, it is questionable that one can use persons in related jobs in the hope that they can provide valid data on new tasks or improved data on tasks that are not specific to the vehicle.

When design personnel received guidance from ITD about the tasks that the latter recommended for BNCOC, two interrelated activities were undertaken by design personnel. First, they reviewed the recommended list of tasks and judged, based mostly on experience, whether some tasks should be deleted and others, not on the list, should be added. In addition, other evidence used by them in these judgments came from



reviewing the learning analysis data provided by ITD. This latter review constituted the second activity undertaken by design personnel at this time. The extent of learning analysis information varied across tasks, with more information available about duty specific tasks than about common tasks. Learning analysis information about common tasks was limited to that provided by the current Soldier's Manual; for the other tasks, more detailed information was made available. As a result, design people had little difficulty in making decisions about duty specific tasks but considerable difficulty in deciding about common tasks. In their opinion, more informed decisions about common tasks could be made if more detailed information about the tasks had been provided to them.

#### Additional Tasks for 19K BNCOC

Almost every person who was interviewed about the content of BNCOC suggested additional tasks for the course. The proposed tasks were generally already in the MOS task list; the respondent merely wanted to shift a task from its present skill level and/or training site so that it became SL3X. Some specific actions or tasks that were recommended for addition to BNCOC included the following:

- Navigate while moving in a tank.
- Determine location on a map.
- Set headspace and timing on M2 machinegun.
- Put automatic chemical agent alarm system into operation.
- Issue a fire command.
- Perform degraded mode gunnery.
- Employ tactics while in a tank.
- Acquire a target.

The last three actions are not tasks in the current MOS task list. They represent behaviors or performances that are judged critical by some SME, and they may be steps in tasks that are on the task list. While target acquisition is not now a task, many respondents felt that tank commanders badly needed training in this area, especially when the tank crew must operate in a protective-open hatch position. In the opinion of some, elevating "Acquire a target" to task status would clearly emphasize the importance of the activity, and lead to more explicit training in how to accomplish it under a variety of conditions.

A not unrelated problem centers on the task "Issue a fire command." Although DOTD considered this skill to be part of "Direct gunnery engagement," as a SL32 task, it is not scheduled for formal training. While the students were provided an opportunity to give fire commands during gunnery exercises, these commands were only for three-man crews. Nonetheless, the tank commander is expected to be able to perform the task immediately upon acting as a commander in BNCOC. Considering the variety of fire commands that may be given, the conditions under which they may be given, and the lack of any constructive practice in the activity, it is not surprising that BNCOC students tend to be speechless when the requirement to perform is first thrust upon them.

There was ready agreement among ANCOC and Master Gunner respondents that "Read a map while moving in a tank" is one of the most difficult tasks confronting the tank commander. Navigating on foot is one thing, but navigating in a tank while moving at 20 mph or more is vastly different. Tank commanders have a lot of things to concentrate on while moving at this speed. Before becoming commanders, most were isolated inside the turret so that they had no opportunity to experience the problem. There was open agreement among respondents that additional training in this skill is needed.

Map reading was also acknowledged to be important because of the need to call for artillery support. Although there was some disagreement as to who should call for fire (tank commander vs. platoon leader or platoon sergeant), there was agreement that the tank commander must be able to give the grid location of a point if fire support is to be received on it.

The same respondents also emphasized that "tactics" was another area in which all commanders needed additional training. When pressed for more specific information about tactics, one respondent listed the following as tactical decisions that the tank commander must be able to make:

- a. Deciding where tank will go and when to stop.
- b. Using terrain.
- c. Identifying targets.
- d. Avoiding minefields.
- e. Interpreting hand and arm signals.

Some respondents felt that BNCOC should contain explicit instruction in degraded mode gunnery. They cited, as an example, the tendency to obtain wrong range readouts when operating in fog. Others felt that there were many kinds of degraded situations, and to teach them all in BNCOC would be overwhelming. The latter persons opted to focus on degraded gunnery in units, not in a school.

Among military respondents (BNCOC instructors, ANCOC students, Master Gunner students) there was unanimous agreement that the duration of BNCOC should be lengthened. Recommended class durations ranged from six weeks to six months, with eight weeks a modest compromise. The additional time would be devoted not only to instruction in new areas (e.g., mounted land navigation) but also to more instruction on existing tasks.

Since the 19K BNCOC instructors have the greatest amount of contact with BNCOC subject matter and students, their opinions regarding additions and deletions to the course are particularly pertinent. After the initial presentation of 19K BNCOC, the instructors made the following recommendations:

- a. Include training in Mounted Land Navigation. Need more land navigation tasks performed in the field rather than in the classroom.
- b. Add a task requiring the student to put the M8 Chemical Detector into operation.
- c. Delete instruction in "Identify Terrain Features." This is really a SL1 task and need not be taught in a SL3 course.
- d. Drop the task "Direct Consolidation/Reorganization." It is a platoon task rather than an individual task.
- e. Drop the task "Prepare Oral Operations Order." It is too complex for student. A task that enables him to brief his crew on the coming operation would be better.

A recommendation to add the task "Conduct partial decontamination" to 19K BNCOC was made by a respondent from the NBC Branch, Command & Staff Department, Armor School. The rationale for this task was that partial decontamination of persistent chemical agents from the tank (especially around hatches) will enhance continued operations. The same respondent recommended that the task "Use an AN/PDR-27 Radiac Set" be deleted from BNCOC. The basis of issue of this instrument is one per company, and at present, each company has an NBC NCO who should be responsible for the use of the device.

A respondent from the Master Gunner Branch, Weapons Department, Armor School, recommended that the task "Prepare a Sketch Range Card" be added to and included in the task "Select Firing Position." This respondent also recommended that special instruction and practice be given to BNCOC students in the following performance areas: Degraded Mode Gunnery, Fire Commands, and Target Acquisition.

A respondent from Communications Branch of Committee Group recommended that the task "Recognize ECM & Implement ECCM" be modified. The requirement on the student should place emphasis on actions he must take when confronted with interference, rather than on his ability to recall the various types of interference. He also recommended that the soldier be required to submit a simple interference report in place of the MIJI report.

A special Land Navigation Committee established at Fort Knox undertook a review of land navigation requirements and tasks in 19K BNCOC and recommended several changes. The committee identified three terminal objectives for the land navigation block of instruction in 19K BNCOC. These were:

- a. Navigate from one point to another, on roads and cross-country, mounted, using a map.

- b. Determine grid coordinates of a point on a map using the military grid reference system.
- c. Conduct a map reconnaissance to identify and select routes and positions.

Most of the land navigation tasks presently in BNCOC were viewed as enabling objectives, and various minor changes were made to them so that they more directly supported the three terminal objectives identified above. The committee also suggested that three tasks be added to support the terminal objectives. They were:

- a. Determine the elevation of a point on the ground using a map.
- b. Navigate from one point to another with a map, in a vehicle moving at 9 k/hr.
- c. Use marginal information and identify topographic symbols.

Interactive, Problem Solving, and Decision Making Tasks. Early in searching for new tasks, the research staff drafted a hypothetical set of interactive, problem solving, and decision making task statements and submitted the set to various military respondents (BNCOC instructors, ANCOG and Master Gunner students, etc.). They were asked to state informally their opinion about each task (e.g., Should be added to BNCOC, already imbedded in BNCOC, should not be in BNCOC, etc.). Reactions of respondents can best be described as "mixed." Occasionally they approached agreement about a proposed task; more frequently they disagreed. There was no proposed additional task on which all persons uniformly agreed. A frequent response to a proposed task was: "This task is covered in . . ." (other task). By and large, they seemed to maintain that TCs did not make decisions; they also doubted that TCs engaged in problem solving. Instead, they felt TCs simply followed orders or unit SOP.

In light of the failure to identify interactive, problem solving, or decision making tasks from interviews with these respondents, the research staff adopted another approach. Using in-house military and civilian armor experts, tentative sets of interactive, problem solving, and decision making task statements were formulated. These statements were repeatedly reviewed and revised. After many iterations, concurrence was achieved. A more detailed description of procedures that were used is as follows.

The research team began by conducting a "naive" analysis of the tank commander's duties. That is, traditional military concepts and terms were temporarily ignored. The focus of the inquiry was on straightforward matters such as: How does the TC know where to go? Where to stop? What to shoot at? etc. This strategy was used to identify decisions that the TC must make during combat. The list of decisions was modified several times and then, to make sure it was correct militarily, it was submitted to SMEs for their evaluation. Based

on their feedback, the list was corrected and a final list of decision tasks was prepared.

The same approach was used to identify the factors or kinds of information that the tank commanders use in making each decision. It was concluded that the subjective factors that are taken into account in making decisions (e.g., such as amount of protection from enemy direct fire) were the problems that the tank commander had to solve. In effect, then, they are the problem solving tasks that tank commanders perform during combat.

A similar naive analysis of tank commander duties was used to identify the interactive tasks. That is, the research team asked questions like these: What sorts of orders does the TC receive? What tasks require him to coordinate with the section leader or platoon leader? What type of help does he ask for? What type of information does he receive? etc.

#### Recommendations and Conclusions

The following recommendations and conclusions are presented as a result of the analysis that was made of the 19K30 duty position. It was the intent of this analysis to identify additional tasks that should be added to 19K BNCOC and to identify tasks that should be deleted. The reader should note that the recommendations for additions to the course are not complete since they do not include any of the decision making, problem solving, or interactive tasks that were identified during this phase of the project. Since existing task documentation did not focus on these types of tasks, an attempt was made to identify them by interviewing tank commanders, platoon sergeants, and other subject matter experts. This effort was unsuccessful since the interviewees either denied that tank commanders made decisions and solved problems or at least could not generate many examples of decision making tasks and problem solving tasks performed by tank commanders. Consequently, a method had to be devised that would enable the project staff to identify these tasks and to confirm their accuracy. This additional effort caused sufficient delay that it was not possible during Phase 1 of the project to assess the criticality of these tasks nor to determine the extent to which they are subsumed under tasks already taught in BNCOC. This analysis will be conducted at the beginning of Phase 2 so that the results can be implemented in the 19K BNCOC course design. The difficulties involved in identifying the decision making, problem solving, and interactive tasks performed by tank commanders also delayed the identification of tank commander tasks involved in the use of training devices, training aids, and training materials in unit training. These tasks will also be identified during Phase 2 so that they can be incorporated into the course design.

### 19K Tasks Recommended for the 19K BNCOC Program of Instruction

A total of 16 tasks are being recommended as additional tasks to be taught during BNCOC. Eleven of these tasks are in the present 19K task inventory, but none is currently being taught in BNCOC. The tasks to be added are listed below along with the reasons for each recommendation. Included are three tasks that are not critical for combat. These are recommended, along with the critical tasks, because they are important leadership tasks that are performed by tank commanders in garrison.

1. Install/remove the automatic chemical alarm system. This task, which was recommended by the instructors in the NCO academy who are currently teaching 19K BNCOC, combined the following two 2Y tasks: (a) Put the automatic chemical alarm system into operation, and (b) Shut down the automatic chemical alarm system. The two tasks were combined into a single task because they were both focused on the operation of the same piece of equipment. There are two reasons why this task is being recommended for 19K BNCOC. First, adequate performance of the task may be essential in the event of an enemy attack using unseen or unknown chemical weapons. Second, the task is extremely complex. For example, there are 30 pre-operation steps as well as 28 steps in the start-up and operation of the system. Even though the task is performed with the use of a checklist, many of the separate steps are sufficiently complex themselves to warrant formal training. Gauges must be read, a power supply must be used, and temperature must be considered. It is unlikely that a task of this degree of complexity can be adequately learned without formal instruction.

2. Conduct a partial decontamination. This task, which is currently classified as a 1X task, is an emergency procedure which enables the tank to function and the crew to continue its mission following a chemical attack. Complete decontamination must be performed at a decontamination station under the supervision of specialists. Partial decontamination, on the other hand, can be performed by the crew under the supervision of the tank commander and allows the tank to continue in its mission until complete decontamination is possible. Partial decontamination involves the use of the M11 decontamination apparatus to decontaminate the parts of the tank that will be touched by personnel during a mission. These areas include the parts of the tank that will be touched when entering or leaving the tank, the caliber .50 machinegun, and the loader's machinegun. Because the continued operation of the tank after a chemical attack may be critical to success of the mission, we agree with the recommendation made by the NBC instructor in the Support Division of the Command, Staff, and Doctrine Department that the task be included in 19K BNCOC.

3. Prepare a sketch range card. This task, which was suggested by an instructor in the Master Gunner Branch of the Weapons Department, is a modification of a current 3Z task: Prepare a range card on an M1 tank. Since there is no azimuth indicator or elevation quadrant on the present version of the M1 tank (a gunner's quadrant may be included in the M1A1), a traditional range card cannot be prepared. The traditional range card would normally include ranges, elevation, and deflection to targets. Since the M1 tank has a thermal imaging sight system, there is

no real need for much of the information normally contained on a range card. Consequently, the current doctrinal manual, TT 71-1/2, The Abrams Battalion (March 1982), indicates that crews prepare a sketch range card for primary and alternate positions during the deliberate occupation of a battle position. The sketch range card would show key landmarks, sectors of fire, target reference points, indirect fire concentrations, other likely target areas, ranges to all likely enemy positions, and obstacles. By including this task in 19K BNCOC, tank commanders could learn standardized procedures for preparing a sketch range card while in a formal training environment.

4. Receive and orient newly assigned crewman. This task combines and slightly modifies two tasks that are currently classified as 2Z: (a) Receive newly assigned unit personnel, and (b) Orient newly assigned unit personnel. Tank commanders, of course, would only receive and orient newly assigned crewmen. One reason that this task is being recommended for 19K BNCOC is that it is the responsibility of the tank commander to receive and orient new crewmen. Another reason for the recommendation stems from the possibility that crew morale would suffer in the event that the tank commander delegates the performance of the task to another crew member.

5. Prepare the rater's section of an Enlisted Evaluation Report (DA Form 2166-6). This is a modification of a 2X task: Prepare the rater's/ indorser's/reviewer's sections of an Enlisted Evaluation Report (DA Form 2166-6). The recommendation is made that the task be raised to a 3X level since it is a leadership task that would not be performed by any of the other crew members. The recommended modifications are necessary, however, since tank commanders do not prepare the indorser's and reviewer's sections of the report. The periodic evaluation of a crewman by the tank commander is a serious matter since ratings can affect both promotions and reenlistment. The rater must thoroughly understand the Enlisted Evaluation System, its consequences, and the need for unbiased objectivity. The task, in its modified form, is recommended for 19K BNCOC since there is no other institution at which it can be learned.

6. Conduct search in accordance with the Uniform Code of Military Justice. This task is currently classified as 3Z. Recent history confirms the conclusion that the American judicial system zealously safeguards the rights of the accused. As a result, formal charges are frequently dismissed because of illegal search and seizure. It is recommended that this task be included in 19K BNCOC in order to prevent the dismissal of valid charges as a result of illegal search procedures.

7. Conduct a map reconnaissance. This task, which is currently a 3Z task, was recommended by the Land Navigation Committee at Fort Knox. The task requires the tank commander to conduct a reconnaissance of an area or a route before moving into an area or prior to moving along the route using a map. Tank operations are characterized by depth of movement. A unit may move as many as 20 to 40 kilometers in one day. In some rare instances, the tank commander may be taken to an observation post where the terrain feature can be observed. In most cases, however, pre-operations reconnaissance is limited to a map reconnaissance. The task is important because it enables the tank commander to identify

potential problem areas (e.g., defiles, likely enemy positions, difficult terrain, obstacles). It is because of the importance of the task as well as its difficulty that it is being recommended for inclusion in 19K BNCOC.

8. Conduct a tactical road march. This task is currently classified as a 3Z task. Although the task is presently taught in BNCOC during the preparation for an STX, it is not contained in the Program of Instruction. The task requires the tank commander to maintain his position in a platoon formation, to maintain main gun orientation in accordance with the platoon SOP, and to maintain air and ground observation in accordance with this SOP. It is included in the list of tasks recommended for inclusion in 19K BNCOC in order to emphasize the need for formal instruction in intra-platoon coordination and the maintenance of movement standards.

9. Set headspace and timing on a caliber .50 machinegun. This is a 1X task that is currently taught in OSUT. The task, however, is complex and difficult to retain without practice. Since a tank commander is the crew member who fires the caliber .50 machinegun, and since he can become injured if the gun is improperly timed, the task is normally performed only by the tank commander. Consequently the other members of the crew receive no opportunity to practice the task. Therefore, it is recommended that the task be taught in 19K BNCOC. This recommendation was also made by the ANCO students who were interviewed during this phase of the project.

10. Prepare situation report (SITREP). Although this is classified as a 3Z task, the procedures involved in preparing a situation report are rather complex. A situation report should be submitted at least once daily and whenever it is necessary to report changes, request resupply, or report locations and situations. The format includes pre-designated paragraphs, and locations and quantities that are encrypted. The CEOI brevity code is used when appropriate. Since tank commanders have few opportunities to practice the performance of this task, it is recommended that the task be taught in 19K BNCOC.

11. Issue fire command. This is currently classified as a 3Z task despite the difficulties involved in issuing adequate fire commands. Consequently, while students in 19K BNCOC practice issuing fire commands in the field, there is insufficient classroom practice provided in the performance of the task, and practice in the field is limited to gunnery from the tank commander's station. While the task is a subtask of the 3X task "Direct main gun engagements on an M1 tank," it is being recommended for inclusion in BNCOC as a separate task in order to emphasize the importance of providing formal training in the issuance of fire commands.

#### Other Tasks Recommended for the 19K BNCOC Program of Instruction

A total of five tasks, not currently in the 19K task inventory, are recommended for inclusion in 19K BNCOC.



1. Conduct target acquisition. This task is not in the 19K10-40 master task list, but it was recommended for inclusion in BNCOC by an instructor in the Master Gunner Branch of the Weapons Department. It is one of the most important tasks performed by the tank commander, and is the initial task involved in tank gunnery engagements and survival. It is also a complex task since it involves coordination with other tanks and crewmen over sectors of observation; techniques of search; search at the halt and while moving; search with unaided eyes, binoculars, and various optics; the identification of objects (e.g., friend or foe, type); and the location of targets. The training of target acquisition on existing gunnery ranges is undesirable since target arrays are not representative of actual enemy target arrays and since these arrays quickly become known to the participants. It is recommended that this task be included in 19K BNCOC as a separate task in order to emphasize the importance of formal training in target acquisition.

2. Maintain position in platoon formation. This task was suggested by the ANCOC and Master Gunner students who were interviewed during this phase of the project. The task requires the tank commander to maintain the position of his tank in relation to the platoon leader or the platoon sergeant during various platoon formations. It also requires that the tank commander ensure that his assigned sector of fire and observation be maintained. Because of the current emphasis on the wingman concept and the various platoon formations, it is important that tank commanders be formally trained to perform this task.

3. Use marginal information on a map. This task requires the tank commander to understand and use the information contained in the margin of a map. Included are the use of the scale; symbols; guide line intervals; contour intervals; grid, true and magnetic north; distances; and signs. These skills are required for proper use of the map as a navigation aid and in the performance of a map reconnaissance.

4. Direct evasion of an enemy anti-tank guided missile. While the task "Evade enemy anti-tank guided missiles (ATGM)" is currently a common task that is classified as 1Y, the performance of the task in a tank requires coordination between the tank commander and the driver. Because of the better perspective available to the tank commander from the TC's hatch, the tank commander is frequently in a better position than the driver to determine what actions should be taken to evade an ATGM. These actions include giving a contact report, directing the driver to take evasive action, directing the driver toward a defilade position, slewing the main gun toward the missile firing site and engaging it, possibly popping or generating smoke, and if popping smoke, ordering that the hatches be closed first. Considering the likelihood of encountering an ATGM in combat and its lethality, this task warrants formal instruction in 19K BNCOC.

5. Employ a three-man crew on an M1 tank. Because of the likelihood that a tank will frequently have to be operated with only a three-man crew (due to lack of replacements or a crew casualty), it is recommended that the tank commander be formally trained to operate with less than a full crew. This is a complex task which involves four

actions: (a) reorganizing the remaining three crewmembers into a three-man crew, (b) preparing the tank for three-man crew operations, (c) reviewing three-man crew fire commands with the newly organized crew, and (d) engaging targets with a three-man crew.

#### 19K Tasks Recommended for Modification

1. Establish, enter, or leave a radio net. Since a tank commander cannot establish a radio net, it is recommended that the task be changed to the following: "Enter or leave a radio net."

2. Direct consolidation and reorganization on the objective. This is a 4X task that is included in the POI for 19K in the event that the tank commander must serve as the acting platoon sergeant. Since it is being recommended that only tank commander tasks be included in 19K BNCOC, it is further recommended that the task be modified to include only those duties that would be performed by the tank commander in his normal role. Thus, the recommendation is made to change the task to the following: "Reorganize on the objective."

3. Prepare and issue oral operation order. This is a 4X task that is included in the POI for 19K in the event that the tank commander must serve as the acting platoon sergeant. Since it is being recommended that only tank commander tasks be included in 19K BNCOC, it is further recommended that the task be modified and simplified. A new task that enables the tank commander to brief his crew on the coming operation would be better.

#### 19K Tasks Recommended for Deletion from POI

1. Inspect DA Form 2408-4 (Weapons Data Card) for accuracy. This is a sufficiently simple task that formal training is not required.

2. Use an AN/PDR-27 radiac set. This is a common task involving the use of the radiac set to determine the presence or absence of radiation. Since there is only one radiac set in a tank company, and since the set would be operated by an NBC specialist, there is no need to train tank commanders to perform this task.

3. Determine directions using field expedient methods. This task, which is classified as 1X, is normally not performed during armor operations. Since tanks operate as an integral part of a platoon, and since each tank commander is issued a lensatic compass, there is little need to determine directions using field expedient methods. The task is normally performed only during escape and evasion, and should therefore be taught in OSUT instead of BNCOC.

It should be clear that all tasks recommended for 19K BNCOC should be classified as SL3X tasks. At the same time, it is acknowledged that some tasks in the current program, while quite acceptable, are not now designated 3X. Therefore, it is recommended that the following tasks be changed to SL3X:

<u>Task Title</u>	<u>Current Code</u>
Boresight & System Calibrate the M1 Tank	1X
Use the Automated CEOI	2Y
Install & Operate Hot Loop Wire Communications	3Y
Prepare for NBC Attack	3Y
Conduct Performance Counseling With a Subordinate	3Y
Analyze Terrain Using Five Military Aspects of Terrain	3Y
Engage Targets With M240 Coax	3Y

#### Identification of Decision Making Tasks

A total of 42 decision making tasks were identified. These tasks are listed in Table 1 according to task category (e.g., movement, gunnery, sustainment). The major portion of the effort that went into identifying these tasks focused on decisions that tank commanders make during combat. However, tank commanders also perform many important non-combat related tasks for which they must be trained. Therefore, a few decision making tasks pertaining to training and personnel matters are included as illustrative of the types of decision making tasks performed by tank commanders in garrison.

Five of the eleven decision making tasks pertaining to movement focus on movement into stationary positions such as primary, supplementary, and overwatch positions. Three of the tasks pertain to decisions regarding movement within the platoon or section formation. The remaining decisions pertain to obstacles encountered during movement or when to move to an alternate position. The decisions pertaining to gunnery focused on such matters as whether to shoot, what target to engage, the weapon or ammunition to fire, and when to stop. Ten of the decision tasks pertain to sustainment. These decisions cover a variety of different topics such as the use of smoke, actions to be taken when casualties have been sustained, and maintenance.

In addition to listing the decisions made by tank commanders, Table 1 contains the factors that should be taken into account by the tank commander when making each decision. For example, when the tank commander selects a primary position, he should consider such factors as fields of fire, cover, and concealment.

Table 1

Decision Making Tasks Performed By Tank Commanders  
And the Factors That Are Considered When Performing These Tasks

---

MOVEMENT

1. TC selects primary position within area assigned by platoon leader.
  - A. Fields of fire.
  - B. Cover.
  - C. Concealment.
  - D. Movement route availability.
  - E. Hardstand.
  - F. Existence of prominent feature.
  - G. Disposition of tanks.
2. TC selects alternate position within area assigned by platoon leader.
  - A. Fields of fire.
  - B. Cover.
  - C. Concealment.
  - D. Movement route availability.
  - E. Hardstand.
  - F. Existence of prominent feature.
  - G. Disposition of tanks.
3. TC decides when to move to alternate position.
  - A. Time of tank exposure.
  - B. Likelihood of being hit by enemy fire.
4. TC selects supplementary position within area assigned by platoon leader.
  - A. Fields of fire.
  - B. Cover.
  - C. Concealment.
  - D. Movement route availability.
  - E. Hardstand.
  - F. Existence of prominent feature.
  - G. Disposition of tanks.
5. TC selects specific paths of movement relative to section leader's tank.
  - A. Cover.
  - B. Concealment.
  - C. Trafficability.
  - D. Grade.
  - E. Obstacles.
  - F. Slope.

(table continues)

---

MOVEMENT

- G. Overhead obstructions.
  - H. Distance between obstructions.
  - I. Obstruction to gun tube.
6. TC decides how to maintain position relative to section leader's tank.
- A. Depth interval to section leader's tank.
  - B. Lateral interval to section leader's tank.
7. TC decides whether or not to negotiate an obstacle.
- A. Depth or height of obstacle.
  - B. Width of obstacle.
  - C. Availability of bypass.
  - D. Probability of damaging tank while negotiating obstacle.
  - E. Probability of miring tank while negotiating obstacle.
  - F. Time required to negotiate obstacle.
  - G. Whether bypass will prevent TC from providing cover to section leader's tank.
8. TC decides how to negotiate an obstacle.
- A. Depth or height of obstacle.
  - B. Width of obstacle.
  - C. Capabilities of the tank.
9. TC selects overwatch position within area designated by section leader.
- A. Line of sight to tanks being overwatched.
  - B. Disposition of tanks in overwatch.
  - C. Fields of fire.
  - D. Cover.
  - E. Concealment.
  - F. Trafficability.
  - G. Grade.
  - H. Movement route availability.
  - I. Hardstand.
  - J. Existence of prominent feature.
10. TC selects firing position within area designated by section leader.
- A. Fields of fire.
  - B. Cover.
  - C. Concealment.
  - D. Movement route availability.
  - E. Hardstand.
  - F. Existence of prominent feature.
  - G. Trafficability.
  - H. Disposition of tanks.

(table continues)

---

## MOVEMENT

11. TC decides whether to maintain position relative to section leader when section leader's tank moves in an illogical manner (e.g., into an area in which the tank is likely to become mired).
  - A. Possible motives for section leader's actions.
  - B. Confidence in the section leader.
  - C. Consequences of maintaining relative position.

## DETECTION/IDENTIFICATION

1. TC decides whether to override designated search areas.
  - A. Location of observed target.
  - B. Threat information.
  - C. Terrain characteristics.
  - D. Threat avenues of approach.
2. TC decides where he and loader will search for targets.
  - A. Platoon formation.
  - B. Need to override designated search area.
  - C. Threat direction.
  - D. Threat avenues of approach.
3. TC decides which mode of observation will be used to search for targets e.g., naked eye, binoculars, primary sight).
  - A. Normal mode sequence.
  - B. Clarity of image.
  - C. Availability of observation mode to crew member.

## GUNNERY

1. TC decides whether to shoot at target(s).
  - A. Target range.
  - B. The need to keep presence hidden from threat.
  - C. Availability of ammunition.
  - D. Probability of hitting target.
2. TC decides on order in which to engage multiple targets.
  - A. Degree of target threat.
  - B. Importance of target to accomplishment of threat mission.
3. TC decides when to shoot at target(s).
  - A. Target range.
  - B. The need to keep presence hidden from enemy.

(table continues)

---

## GUNNERY

4. TC decides what weapon to shoot.
  - A. Firepower necessary to destroy target.
  - B. Target range.
  - C. Availability of ammunition to use if main gun is to be fired.
5. TC decides what ammunition to use if main gun is to be fired.
  - A. Firepower necessary to destroy target.
  - B. Availability of ammunition types.
  - C. Hit probability.
  - D. Target range.
  - E. Types of targets anticipated before resupply.
6. TC decides when to stop firing.
  - A. Nature and extent of damage to target.
  - B. Battlefield cues (e.g., smoke, fire lack of movement, target attitude).
  - C. Consistent failure to hit target.

## SUSTAINMENT

1. TC decides which crewmen will sleep, how long, and where.
  - A. Need to maintain security.
  - B. Maintenance of individual readiness.
  - C. Crewman stress or fatigue.
2. TC decides whether a crewman must be evacuated due to casualty or illness.
  - A. Severity of casualty or illness.
  - B. Present combat situation.
  - C. Anticipated battlefield situation.
3. TC decides who will drive tank when driver is a casualty.
  - A. Driving experience of gunner and loader.
  - B. Number of crew position changes required.
4. TC decides whether to close (or open) hatches.
  - A. NBC warnings or conditions.
  - B. Need to pop smoke grenades.
  - C. Effects of hatch position on observation.
5. TC decides whether or not to fire smoke grenades.
  - A. Enemy direct fire threat.
  - B. Time to reach cover.
  - C. Availability of smoke grenades.
  - D. Direction and speed of wind.

(table continues)

---

## SUSTAINMENT

6. TC decides whether to generate smoke.
  - A. Direction of movement.
  - B. Fuel level.
  - C. Enemy direct fire threat.
  - D. Time to reach cover.
  - E. Direction and speed of wind.
7. TC decides whether to move to covered position.
  - A. Degree of enemy threat.
  - B. Availability of cover.
  - C. Time to reach cover.
  - D. Movement route available.
  - E. Trafficability.
8. TC selects covered position.
  - A. Distance to position.
  - B. Location of position relative to position of enemy.
  - C. Trafficability.
  - D. Concealment.
  - E. Movement route available.
  - F. Protection from direct fire weapons.
9. TC decides during operational checks what maintenance is required and which of these must be performed immediately.
  - A. Severity of the problem.
  - B. Ability to perform the required maintenance.
  - C. Effect of problem on system performance.
  - D. Effect of problem on platoon mission.
  - E. Effect of tank loss on platoon mission.
10. TC decides whether to take evasive actions.
  - A. Immediacy of threat.
  - B. Time required to destroy enemy.
  - C. Trafficability.

## COMMUNICATIONS

1. TC decides whether to break radio listening silence.
  - A. Command policy.
  - B. Criticality of situation.
  - C. Anticipated effects of enemy detection of radio communication.
2. TC selects mode of communications.
  - A. Required speed of communications.
  - B. Required accuracy of communications.
  - C. Required security of communications.

(table continues)



---

## COMMUNICATIONS

3. TC decides sequence of tasks to follow (e.g., shoot or communicate first).
  - A. Immediacy of threat.

## TRAINING

1. TC decides what tasks will be trained.
  - A. Performance test results.
  - B. Observed task performance.
  - C. Task criticality.
  - D. Time available for training.
  - E. ARTEP and annual gunnery exercise schedules.
2. TC decides what method will be used to train each task.
  - A. Applicability of method to task to be trained.
  - B. Availability of required training materials.
  - C. Availability of required training areas and equipment.
3. TC decides how much training each crewman will receive.
  - A. Time available for training.
  - B. Performance test results.
  - C. Observed task proficiency.
4. TC decides what training devices and materials will be used to train each task.
  - A. BTMS guidance.
  - B. Availability of training devices and materials.
  - C. Nature of task being trained.

## PERSONNEL

1. TC assigns personnel to crew positions.
  - A. Crewmen experience.
  - B. Physical status of crewmen.
2. TC selects crewman for award.
  - A. Actions performed by crewman.
  - B. Nature of award.
3. TC recommends crewman for promotion.
  - A. Authorization of promotion slot.
  - B. Performance of crewman.
4. TC recommends punishment for crewman.
  - A. Nature of offense.
  - B. Nature of punishment.

(table continues)

---

PERSONNEL

5. TC decides whether or not to recommend crewman for leave.
- A. Leave time available.
  - B. Crewman performance.
  - C. Effect of crewman absence on projected operations.
-

### Identification of Problem Solving Tasks

A total of 66 problem solving tasks were identified. These tasks are listed in Table 2 according to the same task categories used in presenting the decision making tasks. Each problem solving task corresponds to a subjective factor that the tank commander should take into account when making a decision. Although the problem solving tasks are described in terms of the types of judgments that are required by the tank commander, the specific terms that were used as factors in the decision making tasks are presented in parentheses.

Since the problem solving tasks are linked to specific tank commander decisions, the topics to which they pertain correspond closely to the topics to which the decision making tasks pertain. Thus, several of the problem solving tasks pertaining to movement are concerned with problems involved in selecting positions or in overcoming obstacles to movement.

It should be noted that a given solution to a problem does not automatically infer that a particular decision will be made. For example, even though a tank commander judges that a particular position provides sufficient protection from direct enemy fire, this factor is only one of many that are involved in selecting a firing position. The position that provides the best cover may provide inadequate ground support for the tank or may not be readily accessible.

Table 2

Problem Solving Tasks Performed By Tank Commanders During Combat

---

MOVEMENT

1. TC determines the degree to which the tank will be able to shoot at enemy targets without interference from such features as terrain, vegetation, man-made objects, etc. (FIELDS OF FIRE)
2. TC judges the degree to which the tank will be protected from direct enemy fire. (COVER)
3. TC judges the degree to which the tank will not be detectable by the enemy. (CONCEALMENT)
4. TC detects or finds a route over which the tank can move into or out of a position. (MOVEMENT ROUTE AVAILABILITY)
5. TC determines the degree to which the terrain or condition of the ground will provide support for the weight of the tank. (HARD-STAND)
6. TC judges the degree to which an obvious landmark or structure, such as a lone tree, will call attention to the tank. (PROMINENT FEATURE)
7. TC determines the degree to which two or more tanks are sufficiently dispersed so that the detection of one tank does not automatically result in the detection of the other(s), while at the same time they are sufficiently close so that they can mutually support each other. (DISPOSITION OF TANKS)
8. TC estimates the amount of time the tank has been detectable by the enemy. (EXPOSURE TIME)
9. TC estimates the likelihood of being hit by enemy direct fire. (LIKELIHOOD OF BEING HIT BY ENEMY FIRE)
10. TC estimates the degree to which the terrain will be negotiable by the tank. (TRAFFICABILITY)
11. TC estimates the likelihood that the tank will be able to climb an incline. (GRADE)
12. TC determines whether the tank will be able to negotiate obstacles to movement such as ditches, barricades, or streams. (OBSTACLES)
13. TC estimates the likelihood that the tank will be able to negotiate ground that is sloped. (SLOPE)

(table continues)

---

MOVEMENT

14. TC determines whether tank can clear an overhead obstruction. (OVERHEAD OBSTRUCTIONS)
15. TC determines whether tank can pass between two obstructions. (DISTANCE BETWEEN OBSTRUCTIONS)
16. TC determines whether gun tube can clear obstruction. (OBSTRUCTION TO GUN TUBE)
17. TC determines whether the forward or rear distance to the section leader's tank is close enough to maintain visual contact and provide cover, yet far enough so that both tanks cannot be destroyed by the enemy simultaneously. (DEPTH INTERVAL)
18. TC determines whether the lateral distance to the section leader's tank is close enough to maintain visual contact and provide cover, yet far enough so that both tanks cannot be destroyed by the enemy simultaneously. (LATERAL INTERVAL)
19. TC judges whether an obstacle, such as a ditch, is too deep for the tank to negotiate. (DEPTH OF OBSTACLE)
20. TC judges whether an obstacle, such as a wall, is too high for the tank to negotiate. (HEIGHT OF OBSTACLE)
21. TC judges whether an obstacle, such as a canal, is too wide for the tank to negotiate. (WIDTH OF OBSTACLE)
22. TC determines whether there is a route that is available that would enable the tank to bypass an obstacle, enemy position, etc. (AVAILABILITY OF BYPASS)
23. TC judges the likelihood that the tank can negotiate an obstacle without being damaged. (PROBABILITY OF DAMAGING TANK WHILE NEGOTIATING OBSTACLE)
24. TC judges the likelihood that the tank will become mired while attempting to negotiate an obstacle. (PROBABILITY OF MIRING TANK WHILE NEGOTIATING OBSTACLE)
25. TC estimates the amount of time that will be required to negotiate an obstacle. (TIME REQUIRED TO NEGOTIATE OBSTACLE)
26. TC judges whether during movement on a bypass the tank will be able to detect and engage an enemy target before the target can destroy the section leader's tank. (WHETHER BYPASS WILL PREVENT TC FROM PROVIDING COVER TO SECTION LEADER'S TANK)

(table continues)

---

#### MOVEMENT

27. TC judges whether the tank will be able to search for targets in its assigned sector during movement on a bypass. (WHETHER BYPASS WILL CAUSE SURVEILLANCE SOP TO BE BROKEN)
28. TC determines the extent to which a bounding tank will be seen while it bounds from one location to another. (LINE OF SIGHT TO TANKS BEING OVERWATCHED)

#### IDENTIFICATION/DETECTION

1. TC judges whether a sector of observation is too open for enemy targets to try to negotiate or whether it provides adequate concealment for these targets. (TERRAIN CHARACTERISTICS)
2. TC determines the routes over which the enemy is most likely to advance. (THREAT AVENUES OF APPROACH)
3. TC judges where to search for targets when movement conditions (such as during a change from one formation to another) make it impossible to maintain surveillance in a sector dictated by the formation. (PLATOON FORMATION)
4. TC judges whether terrain features, enemy fire, or other factors indicate that the enemy is much more likely to be located in a search area other than the one in which the tank is responsible for maintaining surveillance. (NEED TO OVERRIDE DESIGNATED SEARCH AREA)
5. TC determines likely locations of the enemy. (THREAT DIRECTION)

#### GUNNERY

1. TC determines before firing the degree to which detection by the enemy would decrease the likelihood of successfully completing the mission, decrease the likelihood of destroying the enemy, or increase the likelihood of being destroyed by the enemy. (NEED TO KEEP PRESENCE HIDDEN FROM THREAT)
2. TC determines before firing whether the supply of ammunition is sufficiently low that the remaining ammunition must be saved for the completion of the mission or for the possibility that a greater threat will be encountered. (AVAILABILITY OF AMMUNITION)
3. TC estimates the likelihood that the target will be hit if fired upon. (PROBABILITY OF HITTING TARGET)

(table continues)

---

## GUNNERY

4. TC estimates the likelihood that an enemy weapon system will destroy the tank (or other friendly vehicles) based on effective range, fire- power, visibility, etc., if the enemy weapon system is not destroyed first. (DEGREE OF TARGET THREAT)
5. TC estimates the likelihood that the destruction of an enemy target will prevent the enemy from successfully accomplishing its mission. (IMPORTANCE OF TARGET TO ACCOMPLISHMENT OF THREAT MISSION)
6. TC determines the least powerful weapon on the tank or the least powerful ammunition that is required to destroy an enemy target. (FIREPOWER REQUIRED TO DESTROY TARGET)
7. TC determines before firing whether the supply of ammunition for each tank weapon system is sufficiently low that the remaining ammunition for that weapon system must be saved for the completion of the mission or for the possibility that a greater threat will be encountered. (AVAILABILITY OF AMMUNITION FOR EACH WEAPON)
8. TC determines before firing the main gun whether the supply of different types of 105mm ammunition (e.g., SABOT, HEAT) is sufficiently low that those types must be saved for the completion of the mission or for the possibility that a greater threat will be encountered. (AVAILABILITY OF AMMUNITION TYPES)
9. TC determines before firing the likelihood that different types of enemy weapon systems (e.g., BMP, T72) will be encountered during the remaining portion of the mission or before resupply is possible. (TYPES OF TARGETS ANTICIPATED BEFORE RESUPPLY)
10. TC judges the type of damage that has been inflicted upon the target (e.g., damage to engine, damage to tracks) and the amount of this damage (e.g., target is able to move, but slowly; target is totally destroyed). (NATURE AND EXTENT OF DAMAGE TO TARGET)
11. TC determines the implications of various battlefield events or cues (e.g., smoke or fire indicate that a target has been hit, failure of target to move suggests a mobility kill). (BATTLEFIELD CUES)
12. TC judges the likelihood of a system malfunction based on the failure to hit a target when proper fire procedures have been followed. (CONSISTENT FAILURE TO HIT TARGET)

(table continues)

---

## SUSTAINMENT

1. TC judges the likelihood that the enemy will attempt to destroy the tank and the extent to which such an attempt can be made ineffectual if detected sufficiently soon. (NEED TO MAINTAIN SECURITY)
2. TC determines the extent to which a crewman will be able to function effectively during combat. (MAINTENANCE OF INDIVIDUAL READINESS)
3. TC determines the degree to which a crewman requires rest in order to recover from the effects of combat stress or to reduce fatigue. (CREWMAN STRESS OR FATIGUE)
4. TC judges the degree to which a crewman requires medical attention in order to recover from the effects of a wound or illness. (SEVERITY OF CASUALTY OR ILLNESS)
5. TC judges whether the absence of an injured or ill crewman would interfere with current battlefield actions. (PRESENT COMBAT SITUATION)
6. TC judges whether the absence of an injured or ill crewman would interfere with future activities involved in the accomplishment of the mission. (ANTICIPATED BATTLEFIELD SITUATION)
7. TC determines the capabilities of the gunner and loader to perform the functions of the driver. (DRIVING EXPERIENCE OF GUNNER AND LOADER)
8. TC determines the likelihood that nuclear, biological, or chemical weapons will be used, or if they have already been used, TC determines the danger they pose to the functioning and survival of the tank. (NBC WARNINGS OR CONDITIONS)
9. TC judges the likelihood that a smoke screen will interfere with the enemy's ability to engage the tank. (NEED TO POP SMOKE GRENADES)
10. TC determines the degree to which closing the hatch or placing it in protective mode would interfere with the ability of the tank commander, loader, or driver to detect the enemy or with the ability of the driver to drive the tank. (EFFECTS OF HATCH POSITION ON OBSERVATION AND DRIVING)
11. TC estimates the likelihood that the enemy will destroy the tank using direct fire. (ENEMY DIRECT FIRE THREAT)

(table continues)



---

SUSTAINMENT

12. TC estimates the amount of time that would be required to reach a position offering protection from enemy direct fire. (TIME TO REACH COVER)
13. TC estimates the degree to which the wind will prevent a build-up of a smoke screen between the tank and the enemy or will cause the smoke screen to become rapidly dissipated. (DIRECTION AND SPEED OF WIND)
14. TC determines whether the tank is moving in a direction so that a generated smoke screen would be between the tank and the enemy. (DIRECTION OF MOVEMENT)
15. TC judges whether the amount of remaining fuel is sufficiently low that using some to generate smoke would significantly decrease the likelihood of completing the mission or decrease the likelihood of survival. (FUEL LEVEL)
16. TC estimates the likelihood that the enemy will destroy the tank if preventative measures are not taken. (DEGREE OF ENEMY THREAT)
17. TC determines whether the protection offered by a covered position would provide protection from direct fire originating from the actual location of the enemy. (LOCATION OF POSITION RELATIVE TO POSITION OF ENEMY)
18. TC estimates the likelihood that a maintenance problem would prevent the tank from completing its mission. (SEVERITY OF THE PROBLEM)
19. TC estimates whether a maintenance problem can be corrected given available tools and supplies, maintenance skills of the crew, and available time. (ABILITY TO PERFORM THE REQUIRED MAINTENANCE)
20. TC estimates the degree to which a maintenance problem would interfere with the operation of the system in which the problem appears. (EFFECT OF PROBLEM ON SYSTEM PERFORMANCE)
21. TC estimates the likelihood that the platoon mission can still be successfully completed if a maintenance problem is not corrected. (EFFECT OF PROBLEM ON PLATOON MISSION)
22. TC estimates the likelihood that the platoon mission can be successfully completed without the participation of the tank. (EFFECT OF TANK LOSS ON PLATOON MISSION)

(table continues)

---

#### SUSTAINMENT

23. TC estimates the amount of time available to prevent the enemy from destroying the tank or preventing the success of the mission.  
(IMMEDIACY OF THREAT)
24. TC estimates the amount of time that will be required to engage the enemy. (TIME REQUIRED TO DESTROY ENEMY).

#### COMMUNICATIONS

1. TC estimates the likelihood that the mission will succeed or that the tank will survive only if an appropriate action is taken.  
(CRITICALITY OF SITUATION)
  2. TC judges the increased likelihood that the tank will be destroyed or that the mission will fail if the friendly forces are detected by the enemy. (ANTICIPATED EFFECTS OF ENEMY DETECTION OF RADIO COMMUNICATIONS)
  3. TC judges the increased likelihood that the mission will succeed or that the tank will survive as a result of how rapidly communications are received. (REQUIRED SPEED OF COMMUNICATIONS)
  4. TC judges the increased likelihood that the mission will succeed or that the tank will survive as a result of how well communications are understood. (REQUIRED ACCURACY OF COMMUNICATIONS)
  5. TC judges the decreased likelihood that the mission will succeed or the tank will survive if the contents of a message were known to the enemy. (REQUIRED SECURITY OF COMMUNICATIONS)
  6. TC estimates the amount of time available to prevent the enemy from destroying the tank or preventing the success of the mission.  
(IMMEDIACY OF THREAT)
-

### Identification of Interactive Tasks

The interactive tasks that are performed in combat by tank commanders are contained in Table 3. The tasks are listed according to the same categories that were used in listing the decision making and problem solving tasks. Within each category are two types of interactive tasks--verbal and non-verbal. Non-verbal tasks are those tasks that involve coordination or communication without the use of spoken or written words. The non-verbal tasks pertaining to movement are concerned with the position of the tank relative to the section leader's tank, movement techniques, movement formations, and stop formations. The non-verbal tasks performed during gunnery include various fire patterns as well as coordination involved in providing supporting fire or conducting fire and maneuver. Non-verbal tasks pertaining to communications involve methods of communicating to persons outside the tank using signals, while those pertaining to sustainment involve assistance to other tanks or the redistribution of supplies.

Three types of verbal interactive tasks were identified for each category. The first type involves orders. Since tank commanders cannot give orders to persons outside their own tanks, all the orders listed in Table 3 are those which tank commanders receive. In addition to receiving orders, tank commanders give and receive information. Contained in Table 3 are the types of information the tank commander submits or receives within each category. If the tank commander can only submit a particular type of information (e.g., sketch range card) or can only receive a particular type of information (e.g., platoon fire plan), this is stated in the table. The final type of verbal task involves requests which the tank commander submits.

Table 3

Interactive Tasks Performed By Tank Commanders During Combat

---

MOVEMENT

1. Non-Verbal Tasks

- A. Maintains position of tank relative to section leader's tank.
- B. Maintains orientation of gun in assigned sector.
- C. Adjusts position of tank relative to section leader's tank during turns and direction changes.
- D. Selects firing position relative to section leader's firing position.
- E. Moves tank using bounding overwatch technique.
- F. Moves tank using traveling overwatch technique.
- G. Moves tank using traveling technique.
- H. Moves tank in column formation.
- I. Moves tank in combat column formation.
- J. Moves tank in line formation.
- K. Moves tank in wedge formation.
- L. Moves tank into position in herringbone formation.
- M. Moves tank into position in coil formation.

2. Verbal Tasks

- A. Receives orders.
  - When to move.
  - Where to move.
  - What route to take.
  - What speed to move.
  - What formation to move in.
  - Adjusts position relative to section leader's tank.
  - Takes evasive action.
  - Where to stop.
  - When to stop.
  - Looks for bypass.
  - Selects primary position.
  - Selects alternate position.
  - Selects supplementary position.
  - Moves into supplementary position.
  - Bypass obstacle.
  - What movement formation to use.
- B. Submits or receives information.
  - Presence of obstacles.
  - Trafficability.
  - Terrain characteristics (when unseen).

(table continues)

---

## DETECTION/IDENTIFICATION

### 1. Non-Verbal Tasks

- A. Maintains surveillance in assigned sector.

### 2. Verbal Tasks

- A. Receives orders.
  - Conducts surveillance.
  - Where to conduct surveillance.
- B. Submits or receives information.
  - Identification of target(s).
  - Location of target(s).
  - Number of targets.
- C. Submits requests.
  - Presents password.

## GUNNERY

### 1. Non-Verbal Tasks

- A. Shoots at target(s) in assigned sector.
- B. Shoots in frontal fire pattern.
- C. Shoots in depth fire pattern.
- D. Shoots in crossfire pattern.
- E. Provides supporting fire.
- F. Conducts fire and maneuver.

### 2. Verbal Tasks

- A. Receives orders.
  - When to shoot.
  - Where to shoot.
  - Fire pattern.
  - When to stop shooting.
  - Pops smoke.
  - Generates smoke.
  - Provides overwatch.
  - Provides supporting fires.
- B. Submits or receives information.
  - Contact report.
  - Round sensing for another tank.
  - (Receives) platoon fire plan.
  - (Submits) sketch range card.

## COMMUNICATIONS/COMMAND AND CONTROL

### 1. Non-Verbal Tasks

- A. Communicates using hand and arm signals (with or without flashlight).

(table continues)

---

## COMMUNICATIONS AND CONTROL

- B. Communicates using flag signals.
- C. Interprets panels.
- D. Communicates using pyrotechnics.

### 2. Verbal Tasks

- A. Receives orders.
  - Submits status report.
  - Conducts commo check.
  - Submits NBC-1 report.
  - Submits NBC-4 report.
  - Submits SPOTREP.
  - Submits MIJIREP.
  - Submits SHELREP.
  - Submits SITREP.
- B. Submits or receives information.
  - Communicates electronically.
  - Communicates face-to-face.
  - Reports observations (SPOTREP).
  - Reports activities (SPOTREP).
  - Reports bombing or shelling (SHEL/BOMBREP).
  - Reports detonation of nuclear weapon(s) (NBC-1 Report).
  - Reports characteristics of nuclear explosion (NBC-1 Report).
  - Receives warning of nuclear detonation by friendly forces (STRIKEWARN).
  - Reports radiation readings (NBC-4 Report).
  - Reports radiation levels of crewmen (DOSEREP).
  - Reports jamming characteristics (MIJIREP).
  - Reports status of supplies, personnel, etc. (SITREP).
  - Reports status of sensitive items, weapons, personnel, and heat/weather injuries (QUICKCHECK).
  - Enemy contact.
  - Commo status.
  - Receives change in radio frequencies (coded).
- C. Submits requests.
  - Commo check.

## SUSTAINMENT

### 1. Non-Verbal Tasks

- A. Redistributes supplies (e.g., ammo, POL, rations).
- B. Provides tank to platoon leader/platoon sergeant when their tank is disabled.
- C. Assists in conduct of maintenance on other tank(s).
- D. Provides tow to mired tank.
- E. Slave starts another tank.

(table continues)

---

## SUSTAINMENT

### 2. Verbal Tasks

- A. Receives order.
    - Conducts before, during, and after operations maintenance checks.
    - Executes MOPP level.
    - Closes/opens hatches.
    - Rests crew.
    - Executes feeding schedule.
    - Prepares tank for nuclear attack.
  - B. Submits or receives information.
    - Submits fuel status.
    - Submits ammo status.
    - Submits maintenance requirements.
    - Submits crew status.
    - Submits casualty report.
    - Submits ration status.
    - NBC alert.
    - Submits NBC status (need to decontaminate tank).
    - Chemical alert.
    - Nuclear alert.
    - Minefield alert.
    - Missile alert.
    - Password.
  - C. Submits requests.
    - Fuel.
    - Ammo.
    - Rest.
    - Rations.
    - Maintenance.
    - Medical assistance.
    - Recover mired vehicle.
-

#### SL1 and 2 Tasks To Be Trained By the Tank Commander

Once the 19K BNCOC graduate becomes a tank commander in a unit, he will be responsible for training his crew in individual and collective tasks. Specifically, he will be responsible for refresher training in SL1X tasks that are taught in OSUT. He will also be responsible for initial training of those SL1Y tasks that are not taught by a unit-designated instructor.

Tank commanders also share in the training of SL2 tasks. As in the case of SL1 tasks, some may be taught by unit-designated instructors rather than by tank commanders. It is important to note, however that tank commanders would be responsible for refresher training of the SL2 tasks that they normally do not train initially. A list of SL1 and 2 tasks judged appropriate for initial or sustainment training by tank commanders rather than by unit-designated instructors appears in Table 4.



Table 4

Skill Level 1 and 2 Tasks Tank Commanders Must Be Prepared To Train

- 
1. Communicate using visual signaling techniques.
  2. Mount radio set AN/VRC-64.
  3. Place a combat vehicle (CVC) helmet into operation.
  4. Operate intercommunications set AN/VIC-1.
  5. Evade enemy anti-tank guided missile (ATGM).
  6. Camouflage defensive position.
  7. Clear a caliber .50 HB machinegun to prevent accidental discharge.
  8. Install/remove an M240 coax machinegun on an M1 tank.
  9. Clear an M240 machinegun to prevent accidental discharge on an M1 tank.
  10. Start/stop the engine on an M1 tank.
  11. Drive an M1 tank.
  12. Perform fuel transfer procedures on an M1 tank.
  13. Prepare driver's station for operation on an M1 tank.
  14. Secure driver's station on an M1 tank.
  15. Operate an AN/VVS-2, night vision viewer, in driver's hatch on an M1 tank.
  16. Perform before operations checks and services on an M1 tank.
  17. Perform during operations checks and services on an M1 tank.
  18. Perform after operations checks and services on an M1 tank.
  19. Perform gunner's and loader's preventative maintenance prepare to fire checks and services on an M1 tank.
  20. Perform gunner's and loader's preventative maintenance after firing checks and services on an M1 tank.
  21. Prepare loader's station for operation on an M1 tank.
  22. Secure loader's station on an M1 tank.
  23. Load/unload the 105mm main gun on an M1 tank.
  24. Load/unload an M250 grenade launcher on an M1 tank.
  25. Prepare gunner's station for operation on an M1 tank.
  26. Secure gunner's station on an M1 tank.
  27. Engage targets with the main gun from the gunner's station on an M1 tank.
  28. Engage targets with the coax machinegun from the gunner's station on an M1 tank.
-

### Training Devices, Aids, and Materials Available To Tank Commanders

Tank commanders have at their disposal or have ready access to various training devices, aids, and materials that they can use in units to train their crews. These are listed in Table 5 according to the following categories:

- Training Devices. These include such devices as the Full Crew Interaction Simulator (FCIS), Multiple Integrated Laser Engagement System (MILES), and Telfare.
- Training Aids. The training aids that are currently available or that will be available in the near future include the Beseler Cue/See, and the Eye-Safe Simulated Laser Rangefinder (ESSLR).
- Training Materials. Included in this part of Table 5 are manuals, procedure guides, and other printed materials which can be used by the tank commander as reference materials during training (e.g., ARI Booklet, Fire Commands for M1 Tank).

Many of the training devices and aids contained in Table 5 are not yet available. However, all of the items in the table will be available within the next three years. The anticipated availability of each item not yet available is also presented in Table 5. Also presented in Table 5 are the task clusters for which the training devices, aids, and materials are most appropriate.

Table 5

Training Devices, Aids, and Materials Applicable To 19K10-30 Task Clusters

TRAINING DEVICES		AVAILABILITY	TASK CLUSTER
1.	Videodisc Gunnery Simulator (VIGS)	FY86	Target acquisition, tank gunnery, and communications
2.	Full Crew Interaction Simulator (FCIS)	FY86	Target acquisition, tank gunnery, and communications
	- Multiple Integrated Laser Engagement System (MILES)		
	- Laser Target Interface Device (LTID)		
	- Thru Sight Video (TSV)		
3.	Multiple Integrated Laser Engagement System (MILES)	NOW	Target acquisition, tank gunnery, communications, and tactics
4.	Unit Conduct of Fire Trainer (U-COFT)	FY85	Target acquisition, tank gunnery, and communications
5.	Tank Weapons Gunnery Simulation System (TWGSS)	FY87	Target acquisition, tank gunnery, communications, and tactics
6.	Electronic Warfare Simulator (EWS)	FY88	Communications and tactics
7.	Target Acquisition and Identification Trainers (TAIT)	FY87	Target acquisition, tank gunnery
8.	Simulation in Combined Arms Training (SIMCAT)	FY86	Target acquisition, tank gunnery, communications, tactics, and land navigation
9.	Training Set, Fire Observation		Target acquisition, communications, and tactics
10.	Land Navigation Interactive Videodisc	FY85	Land navigation
11.	Videodisc Interpersonal Skills Training and Assessment (VISTA)	NOW	Leadership

(table continues)

TRAINING DEVICES		AVAILABILITY	TASK CLUSTER
12.	Caliber .50 Subcaliber Training Device (TELFARE)	NOW	Tank gunnery
13.	Laser Tank Gunnery Trainer (M55)	NOW	Tank gunnery
TRAINING AIDS		AVAILABILITY	TASK CLUSTER
1.	Sony TV Rover	NOW	Tactics and tank gunnery
2.	Beseler Cue/See	NOW	Information briefings, leadership, training, land navigation, nuclear-biological-chemical defense, communications, mine warfare, weapons, maintenance, and tank gunnery
3.	Eye Safe System for Laser Rangefinder (ESSLR)	FY85	Tactics and tank gunnery
4.	Hand Held Tutor (HHT)	FY85	Tank gunnery, maintenance, and communications
5.	Hand Held Computer (HHC)	FY85	Tank gunnery, maintenance
6.	Personalized Electronic Aid for Maintenance (PEAM)	NOW	Maintenance
7.	MicroTICCIT	FY85	Information briefings, leadership, training, land navigation, nuclear-biological-chemical defense, communications, mine warfare, weapons, maintenance, tank gunnery, and tactics
8.	Training Exercise I (TRAX-I)	FY85	Tactics
9.	Enhanced Three-Dimensional Targets (3DT)	FY87	Target acquisition, tank gunnery, and communications
10.	Armor Remote Target System (ARETS)	FY87	Target acquisition, tank gunnery, and communications

(table continues)

TRAINING MATERIALS		AVAILABILITY	TASK CLUSTER
1.	FM 17-12 Tank Gunnery	NOW	Tank gunnery, target acquisition
2.	FM 17-12-1 Tank Gunnery M1 (Draft)	NOW	Tank gunnery, target acquisition
3.	FM 17-12-7 Tank Gunnery Devices (Draft)	NOW	Tank gunnery
4.	FM 17-13-1 Tank Commander's Guide M1 (Draft)	NOW	Tank gunnery, tactics
5.	FM 17-15 Division 86 Tank Platoon (Test)	NOW	Tactics, communications, NBC, maintenance, and mine warfare
6.	FM 23-5 How to Conduct Training in Units	NOW	All subject areas
7.	DA Pam 310-12 Index and Description of Army Training Devices	NOW	All subject areas
8.	TRADOC Pam 71-9 Catalogue of TASC Training Devices	NOW	All subject areas
9.	TC 11-7 Television Trainer (TVT) User Guide	NOW	Tank gunnery and tactics
10.	TC 25-6 Tactical Engagement Simulation	NOW	Tactics, tank gunnery, target acquisition, and communications
11.	TC 17-15-1 Division 86 Tank Platoon Mission Training Plan	NOW	Tactics, communications, NBC, maintenance, and mine warfare
12.	TM 9-6920-374-12&8 Mount, Gun, Training Device Caliber .50 Machinegun, M179 (TELFARE)	NOW	Tank gunnery, target acquisition, and communications
13.	TM 9-6920-357-10 Laser, Gunnery Trainer, M55	NOW	Tank gunnery, target acquisition, and communications

(table continues)

TRAINING MATERIALS		AVAILABILITY	TASK CLUSTER
14.	TM 9-1265-369-10-1 MILES Operations Manual for M60A1/AS/M1	NOW	Tactics, tank gunnery, target acquisition, and communications
15.	TM 9-6920-704-10 Eye Safe System for Laser Rangefinder (ESSLR)	NOW	Tactics and tank gunnery
16.	Booklet Fire Commands for M1 Tank <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
17.	Booklet Classifying Targets <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
18.	Booklet Ammunition/Weapon Selection <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
19.	Booklet Fire Command Elements and Sequence <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
20.	Booklet Single Target Engagement <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
21.	Booklet Multiple/Simultaneous Target Engagements <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
22.	Booklet Degraded Mode Gunnery <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
23.	Booklet M1 Tank Degraded Mode Gunnery <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
24.	Booklet M1 Tank Degraded Mode Gunnery Non-Immediate Engagements <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
25.	Booklet M1 Tank Gunnery Multiple Returns <sup>a</sup>	FY84	Target acquisition, tank gunnery, and communications
26.	Booklet M1 Tank Gunnery Handoff Practice (ARI Research Product)	NOW	Target acquisition, tank gunnery, and communications

<sup>a</sup>This product was developed by ARI and is currently under review by the Armor School Weapons Department.

(table continues)

TRAINING MATERIALS		AVAILABILITY	TASK CLUSTER
27.	Booklet M1 Tank Gunnery Target Tracking and Leading Practice (ARI Research Product)	NOW	Target acquisition, tank gunnery, and communications
28.	Handbook for Sight Picture Training M1 Tank (USARMS Publication)	NOW	Tank gunnery
29.	Guide <sub>b</sub> (TC) M1 Abrams Procedure Guide	FY84	Tank gunnery and maintenance
30.	Guide <sub>b</sub> (GN) M1 Abrams Procedure Guide	FY84	Tank gunnery and maintenance
31.	Guide <sub>b</sub> (LD) M1 Abrams Procedure Guide	FY84	Tank gunnery and maintenance
32.	Guide <sub>b</sub> (DV) M1 Abrams Procedure Guide	FY84	Tank gunnery and maintenance
33.	SOP Division 86 Tank Platoon SOP (Draft)	NOW	Tactics, communications, NBC, maintenance, and mine warfare
34.	TEC 920-777-0500-J Functions and Operations of the Beseler Cue/See	NOW	Training
35.	TEC 920-061-0500-F Introduction to TEC	NOW	Training

<sup>b</sup>This product was developed by ARI. It is currently under review by the Armor School Maintenance Department and has been submitted to DARCOM as a recommended replacement for the Technical Manual Checklist (TMCL).

It should be noted that not all devices, aids, and materials will be available to all tank commanders. Moreover, the tank commander will have different responsibilities with different devices and aids. MILES, for example, may be used during platoon or company level training rather than during crew training, but the tank commander may still be responsible for installing the device on his tank. It should also be noted that the specific tasks which the tank commander must be able to perform to use each training device, aid, or material have not yet been identified. These will be identified during the second phase of the project.

#### Prerequisite Tasks for 19K BNCOC

Two types of tasks were identified that are prerequisites for the tasks that are to be learned during 19K BNCOC. Table 6 contains a list of the skill level 1 and 2 tasks that a tank commander must be able to perform in order to learn the skill level 3 tasks. Table 7 contains additional tasks that the tank commander must be able to perform in order to role play as a gunner, driver, or loader during BNCOC. Since it is necessary to operate an M1 tank during a gunnery exercise or during a Situational Training Exercise (STX), 19K students must be able to perform certain 19K10-20 tasks normally performed by crewmen in other positions. These additional tasks are listed in Table 7.



Table 6

19K10-20 Tasks That Are Prerequisites for 19K30 Tasks  
Taught in BNCOC Or Recommended for BNCOC

- 
1. Put on and wear an M24, M25, or M25A1 protective mask.
  2. Determine the grid coordinates of a point on a military map using the military grid reference system.
  3. Identify terrain features (natural and man-made) on a map.
  4. Measure distance on a map.
  5. Install/remove the M21 metallic antitank mine.
  6. Disarm the M21 metallic antitank mine.
  7. Install/remove the M16A1 antipersonnel mine.
  8. Disarm the M16A1 antipersonnel mine equipped with trip wires.
  9. Install/fire or recover an M18A1 Claymore mine.
  10. Visually identify threat aircraft.
  11. Recognize and identify friendly and threat armored vehicles.
  12. Clear a caliber .50 M2 HB machinegun to prevent accidental discharge.
  13. Determine directions using field expedient methods.
  14. Communicate using visual signaling techniques.
  15. Send a radio message.
  16. Operate radio set AN/VCR-64.
  17. Place a combat vehicle crewman (CVC) helmet into operation.
  18. Operate intercommunications set AN/VIC-1.
  19. Change overgarments, overboots, and gloves using the buddy system.
  20. Put on and wear protective clothing in accordance with established mission oriented protective posture (MOPP) levels.
  21. Identify minefield markers.
  22. Camouflage defensive position.
  23. Use challenge and password.
  24. Collect and report information (SALUTE).
  25. Place into operation an AN/PVS-5.
  26. Perform before operations checks and services on an M1 tank.
  27. Perform during operations checks and services on an M1 tank.
  28. Perform after operations checks and services on an M1 tank.
  29. Give the alarm for a chemical or biological (CB) hazard.
-

Table 7

19K10-20 Tasks That Are Prerequisites When the Tank Commander  
Is Role Playing As Gunner, Loader, Or Driver During BNCOC

- 
1. Mount radio set AN/VCR-64.
  2. Perform fuel transfer procedures on an M1 tank.
  3. Operate an AN/VVS-2, night vision viewer, in driver's hatch on an M1 tank.
  4. Perform before operations checks and services on an M1 tank.
  5. Perform during operations checks and services on an M1 tank.
  6. Perform after operations checks and services on an M1 tank.
  7. Secure driver's station on an M1 tank.
  8. Evade an antitank guided missile (ATGM).
  9. Install/remove an M240 machinegun on an M1 tank.
  10. Zero the M240 coax machinegun on an M1 tank.
  11. Clear an M240 machinegun to prevent accidental discharge on an M1 tank.
  12. Start/stop the engine on an M1 tank.
  13. Drive an M1 tank.
  14. Prepare driver's station for operation on an M1 tank.
  15. Perform gunner's and loader's preventative maintenance prepare to fire checks and services on an M1 tank.
  16. Perform gunner's and loader's preventative maintenance after firing checks and services on an M1 tank.
  17. Prepare loader's station for operation on an M1 tank.
  18. Secure loader's station on an M1 tank.
  19. Load/unload the 105mm main gun on an M1 tank.
  20. Load and unload an M250 grenade launcher in an M1 tank.
  21. Prepare gunner's station for operation in an M1 tank.
  22. Secure gunner's station in an M1 tank.
  23. Engage targets with the main gun from the gunner's station on an M1 tank.
  24. Engage targets with the M240 coax machinegun from the gunner's station on an M1 tank.
-

## Summary

The purpose of this phase of the project was to identify additional 19K tasks for possible incorporation into 19K BNCOC and to examine the tasks that are currently taught in the course in order to determine which, if any, should be deleted. While a large portion of this effort focused on the identification of critical tasks which may have been overlooked or discarded in the initial analysis of the 19K duty position (which was performed before the M1 tank was issued to units), a major portion of the effort focused on the identification of non-procedural tasks performed by tank commanders in combat but which have not been focused upon during traditional front-end analyses. These non-procedural tasks were of three types. The first of these pertained to decisions that are made by tank commanders. Although there is little documentation available describing decisions made by tank commanders, and although the persons who were interviewed denied that tank commanders make many decisions in combat, an analysis of tank commander duties revealed that they make a substantial number of decisions during combat. These decisions were identified during the first phase of the project and will be examined in more detail during the second phase to determine which should be incorporated into BNCOC. Appropriate instruction will then be designed.

The second type of non-procedural tasks pertained to problem solving activities performed by tank commanders during combat. These tasks were defined as subjective judgments serving as inputs into decisions. For example, a tank commander must subjectively evaluate the adequacy of cover and concealment when selecting an overwatch position. Like decision making tasks, problem solving tasks are not well documented and their identification required an extensive analysis of tank commander duties. These tasks, along with the decision making tasks, will also be examined during the next phase of the project to determine which should be taught in BNCOC. Appropriate instruction will then be designed.

A third type of non-procedural tasks pertained to interactions between the tank commander and persons external to the tank. Like decision making and problem solving tasks, interactive tasks have not generally been examined during the analysis phase of course development. Because of the importance of coordination between tanks and other elements on the modern battlefield, a major portion of the effort during the first phase of the project was devoted to identifying interactive tasks involving tank commanders. These tasks will also be examined in detail to determine which should be taught in BNCOC, and then appropriate instruction will be designed.

In addition to supplementing the list of procedural tasks performed by tank commanders and identifying non-procedural tasks that were not the traditional focus of previous analyses, a major part of the effort during the first phase of the project was devoted to identifying the training devices, aids, and materials that can be used by tank commanders in BNCOC when serving as students or in units when training their crews. Tank commanders must not only be aware of the existence of these

devices, aids, and materials, they must also know how to use them properly. Devices, aids, and materials currently available for use by tank commanders or that will be available for their use during the next three years were identified. The focus of this effort was on devices and aids based on new technology since tank commanders may require special training in order to accept their role in training and to know how to use them. A more detailed review of the impact of technology on tank commander training is contained in Part II of this report. During the next phase of the project, the specific task requirements for the utilization of these devices, aids, and materials will be identified and these will be incorporated into the BNCOC course design.

## PART II: TRAINING SYSTEMS AND TECHNOLOGY CONSIDERATIONS

### Background

The problems associated with implementing SAT policy are epitomized when training developers are faced with the SAT requirement to recommend training systems or devices for the programs that they develop. Here an acute problem arises for two reasons. First, training systems are being introduced at a rapid rate and will continue at a rapid rate for the next several years. Second, technologies themselves are evolving and will continue to evolve at a rapid rate. It is the training developer who must recognize the potential of these systems and technologies with respect to training requirements that must be satisfied. The complexity and development rate of evolving systems and technologies make it difficult for training developers to keep abreast of available alternatives to satisfy training needs.

The training system and technology problem is not restricted to training developers. Soldiers in certain job positions, such as the 19K BNCOC instructors and the students (who must later conduct training as an integral part of their post-BNCOC job) must be trained to know the capabilities of evolving training systems as well as how to use them. Since tank commanders are generally unfamiliar with these new training systems, they may resist their use. Introducing tank commanders to these systems in BNCOC should decrease this resistance and increase the likelihood of their use in units. Since operating these systems is not a critical task essential for combat success and survival, it is not included in task inventories. As a result, few, if any, training programs, such as the 19K BNCOC program, provide training on the use of training systems. Thus, increased awareness of evolving training systems and technologies is necessary not only for training developers, but for BNCOC students who become unit trainers in post-BNCOC jobs, as well as for BNCOC instructors responsible for applying sophisticated training systems in the BNCOC program.

### Objective

The objective of this report section is to identify training systems and technologies that have the potential of benefitting the 19K BNCOC program. The technologies and training systems of interest are those which probably will be available within the next three years. Identifying training systems and technologies beneficial to the 19K BNCOC program will permit 19K BNCOC program training developers to address not only current, but near-future, technologies and training systems when considering:

- 19K BNCOC Training Developers - Army training programs are not static. They all must be revised constantly to reflect changes in doctrine and weapon systems, as well as changes

in instructional methodologies/technologies. The applicability of the identified training systems and technologies to specific 19K BNCOC task clusters will also be discussed. This will ensure further investigation of these systems and technologies by training developers before they make final training system and/or device recommendations. Given the recent initiatives in the application of technologies to courseware development (e.g., MicroTICCIT), there also is a need to inform the BNCOC training developer of the methodologies, technologies, and systems that will facilitate instructional development.

- 19K BNCOC Students - Here, two considerations must be addressed. First, the training systems and technologies that are to be incorporated into the 19K BNCOC training program must be identified. This will result in the identification of training systems and technologies with which the BNCOC student must be familiar. Second, the systems and technologies to be used by the 19K BNCOC student later in his role as a unit trainer must be identified. In this case, the use of the unit training systems identified may constitute a 19K BNCOC training requirement.
- 19K BNCOC Instructors - Those technologies and training systems identified in this document that are recommended for and implemented in the 19K BNCOC program will constitute a set of instructor training requirements. Specifically, the 19K BNCOC instructors must be able to employ the training systems and technologies that are to be included in the new 19K BNCOC program.

Both tangible and intangible benefits will result from identifying near-future training systems and technologies in the manner described. The locus of intangible benefits centers on saving time and reducing redundancy. Increasing the training developer's awareness of the training systems and technologies identified, and specifying their applicability to 19K BNCOC task clusters will result in decreased manpower expenditures. Some task clusters, land navigation, for example, are not unique to the 19K BNCOC program. As a result, training devices that satisfy land navigation training requirements in one training program could prove beneficial to other training programs. Identification of training devices during the development of a training program will reduce the probability of redundant training system and courseware development. These intangible benefits (i.e., saving time and reducing redundancy) will result in tangible benefits--cost savings.

#### Approach

The approach to the identification of training systems and technologies which should be considered in the development of the 19K BNCOC program evolved as a result of three questions being answered: (1) What is meant by the terms "training systems" and "technologies"? (2) What

were the information requirements? and (3) What were the information sources?

#### Definition of Terms

Before an approach could be developed, it was necessary to define "training systems" and "technologies." Therefore, in the context of this document, these terms were defined as follows:

- Training Systems - "System, in this context, implies a device or procedure/methodology, or combination of both, that is all inclusive, i.e., it includes all the hardware (e.g., physical components) and software (e.g., documentation and/or programs) necessary to be used as a training vehicle. As such, it can be used "as is" and does not require any modifications or additional developmental effort to be used in either an institutional or a unit environment.
- Technologies - This term is defined as any technical methods that might be applied to achieve a training requirement. By themselves, technologies cannot be used "as is" to satisfy any training requirement. Instead, they are methods or techniques which can be applied to the development of or actually incorporated into training systems (i.e., a means to satisfying an end). The technologies addressed in this document represent methods or techniques that training developers should consider when faced with the responsibility of actually developing training and/or developing a specification for a training system.

These definitions differentiate training systems from technologies. In doing so, they serve to clarify the forthcoming discussions. In addition, the definitions provide the necessary structure or framework within which to case training system and technology considerations.

#### Information Requirements

Given the objective of this effort and definitions of the two terms, it was then necessary to determine the specific information requirements. To do this, a comprehensive review of the 19K BNCOC Program of Instruction and the 19K BNCOC task inventory was necessary. This review provided the foundation upon which specific information requirements were identified.

Training system technology information requirements varied depending upon whether the information need was associated with the 19K BNCOC training developers, instructors, or students. These information needs were best expressed in the form of questions.

With respect to training developers, three questions had to be answered: (1) What existing training systems could be used to satisfy specific 19K BNCOC training requirements? (2) In cases where training

actually had to be developed, what systems could be used to facilitate development of the 19K BNCOC instruction (e.g., MicroTICCIT)? (3) What technologies should be considered when there was a requirement to develop instruction?

With regard to BNCOC students the critical question was: What training systems would the 19K BNCOC student be expected to use as a BNCOC student and later, as a trainer assigned to a unit?

With regard to instructors, the critical question was: What training system must the instructors be able to use to conduct 19K BNCOC instruction, i.e., what are the instructor training requirements? This, of course, cannot be determined until specific training system recommendations have been made and agreed upon. Potential training systems, however, will be identified.

#### Information Sources

Given information requirements in the form of questions, it was necessary to identify potential sources of the information required. This was a critical process and required a comprehensive knowledge of the bureaucracy and Army organizations involved in Army training research and development. Seven primary information sources were identified: the Army Research Institute for the Behavioral and Social Sciences (ARI), the Project Manager for Training Devices (PM-TRADE--under DARCOM), the U.S. Army Training and Doctrine Command (TRADOC), the Army Communicative Technology Office (ACTO--under the joint command of TRADOC and DARCOM), the Tank and Automotive Command (TACOM), the Naval Training Equipment Center (NTEC), and private industry. With ARI and TRADOC, the breakdown of specific information sources is as follows:

- ARI - The following organizations within ARI were contacted:
  - Systems Research Laboratory:
    - Battlefield Information Systems Technical Area
    - Soldier/Computer Interaction
    - Fort Leavenworth Field Unit
    - Battle Simulations
  - Training Research Laboratory:
    - Instructional Technology System Technical Area
    - Training and Simulation Technical Area
    - Presidio of Monterey Field Unit
    - Fort Benning Field Unit
    - Fort Knox Field Unit
    - Fort Leavenworth Field Unit
- TRADOC - The following TRADOC organizations were contacted:
  - U.S. Army Armor School (USAARMS)
    - Directorate of Training and Doctrine (DTD)
    - Training Devices Division (TDD)
  - Training Technology Institute (TTI)



### Information Collection

Information was collected in two ways: direct interviews with representatives of the organizations identified as potential information sources and obtaining and reviewing relevant documentation published by these organizations. Most information collection was initiated via telephone interviews. Interviews usually resulted in identification of relevant documentation that was later acquired, reviewed, and normally followed up with additional phone calls and questions. Individuals interviewed often identified other information sources, and the information collection cycle was then repeated.

### Constraints

During the identification of information sources and the collection of the required information, several research constraints were identified and should be noted. First, it cannot be stated with certainty that all possible information sources were identified. This is true for several reasons, the most important of which is the fact that the Army organizations involved in training R&D are not "listed" as such in any document. As a result, identification of information sources was based solely on the knowledge of the research staff involved in this activity.

The most critical constraint on the collection of information involved the reluctance of information sources to be definitive about the availability date(s) of training systems being discussed. All sources were careful to point out that a "scheduled completion date" on a planning or budgetary document did not necessarily mean the system would be ready at that time given the possibilities of budget cuts, redirection of programs, and developmental difficulties. The degree to which this prevented sources from identifying training systems and technologies is not known. The concerns of information sources must also be echoed with respect to the training systems and technologies that are addressed in this document; although they are anticipated to be available within the next three years, their availability is always subject to the aforementioned factors.

### Findings

The training systems and technology information collection are organized and presented in terms of their relationship and impact on the three groups identified earlier:

- 19K BNCOC training developers
- 19K BNCOC students
- 19K BNCOC instructors

The findings related to each of these groups will be presented in the sections that follow.

## 19K BNCOC Training Developers

As stated previously, there are three topics of concern with respect to training developers, i.e., identification of: (1) training systems that have the potential of satisfying 19K BNCOC training requirements; (2) instructional development systems that may facilitate training development activities; and (3) emerging technologies that should be considered in satisfying training requirements. Each topic will be discussed individually.

Training Systems Considerations. With the rapid advancement of technology and its application to computer systems, there has been an unprecedented proliferation of training systems throughout DoD, federal agencies, and the private sector. Anyone with the responsibility to develop training should be aware of these systems and consider their potential for satisfying identified training requirements. Lack of awareness of existing training systems can result in delayed delivery of the required training, unnecessary expenditures of manpower as well as money, and needless dissatisfaction with "second best" alternatives to satisfying a training requirement.

Identification of training system considerations is best achieved by first listing and describing the systems, and then relating the systems identified to specific 19K BNCOC task clusters. Once this is done, the potential benefits that these systems have to offer the 19K BNCOC program will have been identified.

Training Systems. First, it is necessary to reiterate what the term "training systems" implies. In terms of its relationship to training developers, "training system" implies any system that could satisfy, in whole or in part, one or more of the 19K BNCOC training requirements. This definition does not necessarily imply that a system presented in this document as a "training system" was actually designed as such, i.e., it may have been developed as an operational component of a weapon system as a generalized technological capacity that could be applied to several training systems, or as a research vehicle. For example, the Vehicle Integrated Intelligence (VINT<sup>2</sup>) system is being developed as an operational component of the M1 Abrams tank. Although it is an operational component of the M1 tank, VINT<sup>2</sup> has the potential of facilitating several 19K BNCOC training requirements (e.g., land navigation, communications, and tactics). In addition, there are many "generic" systems being developed to satisfy the requirements of various training systems, simulators, and devices. An example of this is the wide field of view (FOV) display system. The wide FOV display is being developed to satisfy the requirements for presenting wide FOV displays necessary to many tactical and gunnery training systems/simulators/devices. Still another example is the Simulation in Combined Arms Training (SIMCAT) system being developed by the ARI as a training research vehicle. Again, although SIMCAT is a research vehicle, it obviously has the potential of satisfying several 19K BNCOC training requirements (tactics, communications, etc.). Therefore, the term training systems, in this context, has a very broad meaning.

A total of 27 training systems that should be considered by 19K BNCOC training developers has been identified:

- Unit Conduct of Fire Trainer (U-COFT)
- Institutional Conduct of Fire Trainer (I-COFT)
- Mobile Conduct of Fire Trainer (M-COFT)
- COFT Driver Trainer
- Crew Conduct of Fire Trainer (C-COFT)
- Platoon Conduct of Fire Trainer (P-COFT)
- Force-on-Force Trainer
- MK-1 Tank Gunnery Simulator
- Generic Armor Combat Unit Simulator
- Hostile Environment Simulator
- Electronic Warfare (EW) Simulators
- Target Acquisition and Identification Trainers
- Simulation in Combined Arms Training (SIMCAT) System
- Training Exercise I (TRAX I)
- Land Navigation Interactive Videodisc
- Simulation of Area Weapons Effects (SAWE)
- Thermal Sight Engagement Trainers
- Engagement Simulation Exercise Control (ESEC)
- Wide Field of View (FOV) Display
- Enhanced Three-Dimensional Targets (3DT)
- Videodisc Interpersonal Skills Training and Assessment (VISTA)
- Hand-Held Tutor (HHT)
- Hand-Held Computer (HHC)
- Personalized Electronic Aid for Maintenance (PEAM)
- Electronic Clipboard
- Computer-Assisted Simulation of Tactical Voice Communications (SIMCOMM)
- Vehicle Integrated Intelligence (VINT<sup>2</sup>)

The Conduct of Fire Trainers (COFT) is a family of weapon system trainers for gunners and/or vehicle commanders. Using computer generated action scenes, COFTs provide a capability for a wide range of interactive exercises in any geographical area. In a COFT, crew members engage the enemy, face incoming fire, and fire back during exercise scenarios that are depicted in full-color computer generated landscapes. Crew members can fire on the move or at rest (in defilade or at short

halt), and at both moving and stationary targets. COFT systems configured to the M1 Abrams and M60A3 tanks are already in production. Each of these systems is sheltered and can be deployed to any training site. The COFTs have an embedded training management system that provides automated student progress tracking and facilitates individualized instruction. Specifically, the COFT family of training systems (each having the generic attributes just discussed) is comprised of the following systems (the unique features of which are described for each):

- Unit Conduct of Fire Trainer (U-COFT) - This system is configured to handle a single TC and gunner. It possesses all of the generic capabilities described above and is currently in production.
- Institutional Conduct of Fire Trainer (I-COFT) - Currently under development (but expected to be in production soon), the I-COFT is composed of four U-COFT modules, a master control function and an associated training package. It offers the capability for group interaction of entry level soldiers in basic skills in a training school environment.
- Mobile Conduct of Fire Trainer (M-COFT) - the M-COFT is a combination of two shelters of the production U-COFT mounted on a commercially available air ride flat bed trailer. This enables it to be moved from one site to another. Its development is currently being considered.
- COFT Driver Trainer - A tank driver trainer, collocated in the U-COFT shelter complex, will share a portion of an expanded visual image generator in this modified U-COFT. This results in the ability to train drivers in vehicle handling, tactical driving, and night operations concurrently with ongoing U-COFT gunnery training. As is the case with the M-COFT, the development of this trainer is also being considered.
- Crew Conduct of Fire Trainer (C-COFT) - Interfacing the operation of the U-COFT and Driver Trainer, and with the possible addition of a loader's station, a C-COFT would be created. In this application, full crew combat readiness would be sustained with the help of a simulator to the same degree of effectiveness already demonstrated by U-COFT for gunnery sustainment. Should the M-COFT and COFT Driver Trainer be developed, the C-COFT would be a logical "next step."
- Platoon Conduct of Fire Trainer (P-COFT) - Currently well advanced in the design phase, the P-COFT consists of four U-COFT modules integrated and controlled through a platoon coordination station. Each U-COFT is able to interact with the other U-COFT station, and actual engagements and results by one station within line of sight of other stations can be observed by those stations.

- Force-on-Force Trainer - This training system will possess all the capabilities of the U-COFT/P-COFT. In this application, two or more P-COFTs would operate in a common database. They could then oppose each other or team together against an exercise objective. This system is currently in the conceptual phase. However, the logic of its concept (i.e., networking previously developed U-COFTs and P-COFTs) is sound and, if pursued, may be available within the next three years.

The COFT family of trainers comprises a number of specific systems that share a common set of benefits. At the same time, each COFT training system has unique capabilities and consequential benefits. Before considering their application in BNCOC, one should remember that the COFT training systems are currently at various stages of development, i.e., they range from systems currently in production (e.g., the U-COFT) to those that are only now being conceptualized (e.g., the Force-on-Force Trainer). With the exception of the U-COFT, their availability as 19K BNCOC training systems is unknown at this time. For these reasons, all should be considered as training systems that have the potential of satisfying 19K BNCOC training requirements.

The MK-1 Tank Gunnery Simulator is a relatively low cost (i.e., less than a U-COFT), portable, microprocessor-based training system for tank gunners. In its current configuration, it presents stationary/moving, single/multiple targets to a tank gunner station (using videodiscs). Once one or more targets are presented, the system automatically generates commands to the gunner from a simulated TC using the voice track(s) on a videodisc. The gunner then executes the computer generated gunnery commands. The MK-1 has the potential of being modified so that an actual TC could simultaneously view the targets presented to the gunner. The computer generated fire commands could then be omitted and the real life TC could then generate the commands. As such, it could satisfy additional tank gunnery training requirements involving the TC, i.e., a 19K BNCOC student.

The Generic Armor Combat Unit Simulator is a joint PM TRADE and TRADOC initiative seeking to define alternative technological approaches for an institutional armor combat unit simulation system. Its intent is to provide armor platoon and company size units with the ability to experience realistic, real time tactical environments. Its objective is to feature variable tactical scenarios permitting trainees to exercise, under stress, procedural and doctrinal lessons learned in the classroom. The system is expected to incorporate and integrate several technologies including advanced visual systems employing videodiscs and computer generated imagery, robotics, and artificial intelligence. Though this system is not expected to be operational within three years, its developmental by-products (that could be available in three years) could prove beneficial to any training systems being developed for the 19K BNCOC program.

The Hostile Environment Simulator is a joint ARI and PM TRADE program to determine alternative technical approaches for developing a simulator capable of generating a realistic hostile environment (e.g.,

diversity of sophisticated weapon systems in large numbers, relentlessly and violently employed). The intent of the program is to develop a hostile environment simulator that can be adapted to a variety of weapon system and battle simulation training applications. Though the hostile environment simulator is not expected to be operational within three years, the methodologies and technologies applied to its development as well as any pre-operational by-products may become available sooner and could prove beneficial to any 19K BNCOC training development efforts.

A family of Electronic Warfare (EW) Simulators is currently being considered by PM TRADE to satisfy Army-wide training requirements associated with electronic countermeasures (ECM), electronic counter-countermeasures (ECCM), electronic support measures (ESM), the integration of ESM and signal intelligence (SIGNET) activities, and the management of EW as an integral part of combat power. Once a clear definition of EW training requirements has been established, existing EW training systems will be investigated to determine if they can meet EW training and, where they cannot, training systems will be developed. It is anticipated that a family of simulators will be developed to satisfy the diversity of skills involved. The family of simulators envisioned will provide Army schools and operational units with an unconstrained capability for simulating EW environments at varying levels of intensity. As is the case with any development effort, the EW simulator's developmental time line is subject to change. However, efforts are being made to have something available within the three-year period of concern.

Target Acquisition and Identification Trainers are being vigorously developed in a coordinated effort involving many Army agencies. The intent of these efforts is to develop low cost target acquisition trainers or simulators that will support institutional and unit training in threat target detection, identification and location under varying conditions (e.g., night/day, obscured, through TIS and Thermal Imagery Sights). Several trainers are envisioned permitting sensitivity to varying training requirements, e.g., the armor community's need to simulate TIS. These trainers will provide both initial and sustainment training for TCs, gunners, and drivers. It is anticipated that one or more of these trainers will be available within three years.

The Simulation in Combined Arms Training (SIMCAT) system currently being developed by ARI will initially be used as a research vehicle to investigate the application of battle simulations to armor tactical training requirements. However, as an armor platoon battle simulation research vehicle, it could easily be transitioned into an actual training system. As such, it could be used to teach armor platoon leaders, platoon sergeants, and tank commanders the command, control, and communication (C<sup>3</sup>) skills necessary to perform effectively as a unit in a tactical environment. Used in this capacity, SIMCAT can provide the necessary "bridge" between classroom training and practical exercises in a field environment, thereby enhancing the effectiveness of costly field exercises. As a training system, SIMCAT should be viewed as dynamic. Though its current focus is on an armor platoon's C<sup>3</sup>, it could be expanded to accommodate combined arms operations at the

company-team level. SIMCAT will be a fully automated system incorporating voice technology and videodiscs within the architecture of six networked microprocessors. SIMCAT, as a training research system, will be fully operational within three years.

The Training Exercise I (TRAX I), currently being developed by the ARI, is a manual battle simulation adapted from Dunn-Kempf and Blockbuster. TRAX I will provide the ability for tank or mechanized infantry leader personnel to execute Division '86 tactics. In TRAX I, the platoon leader, platoon sergeant, and tank or track commanders simulate communication, fire, and movement actions of their vehicles using miniatures on a terrain board. Mission scenarios used with TRAX I are designed to provide practice on platoon tasks in STXs outlined in TC 17-13-1. This provides a means for tying training objectives to simulation. Though less sophisticated than SIMCAT, TRAX I could also serve to bridge the gap between classroom and field training.

The Land Navigation Interactive Videodisc is currently being developed by ARI for eventual incorporation (within three years) into the 19K BNCOC program. Unlike previously developed general land navigation videodiscs, this videodisc addresses land navigation skills as they relate to M1 tank commanders. Specific topics that will be addressed include identifying terrain features, orienting a map (using map-terrain association), and determining grid coordinates of a point on a map. The MicroTICCIT II (described later) will be used as the instructional delivery system for this videodisc.

Enhanced Multiple Integrated Laser Engagement System (Enhanced MILES) is a combination of initiatives and programs focusing on improving the fidelity of currently fielded MILES systems. These improvements are currently focusing on three major areas of concern to BNCOC, each resulting in a variety of benefits having the potential of satisfying various 19K BNCOC training requirements:

- Simulation of Area Weapons Effects (SAWE) - Current MILES systems accommodate automatic casualty assessment of only armor and infantry direct fire weapon systems, e.g., tank main gun, TOW, or small arms. Because area weapons cause most battlefield casualties, it is imperative that systems be developed and incorporated in MILES that permit the simulation of their deployment, and defense against such weapons. SAWE simulation techniques are currently being developed for indirect fire (artillery and mortars), mines (anti-personnel and anti-armor), NBC (nuclear, biological and chemical), and electronic warfare (EW). SAWE will fill many of the gaps currently inherent in MILES by providing realistic simulations of area weapon visual and aural cues as well as automatic casualty assessments resulting from the employment of such weapon systems. Accomplishing this, SAWE (which should be available within the next three years) represents a training system component of MILES that has the potential of satisfying several 19K BNCOC training requirements.

- Thermal Sight Engagement Trainers - MILES direct fire weapon systems are not effective in "dirty" battlefield environments, e.g., obscured visibility as a result of weather, smoke or dust. Therefore, use of thermal sights under such conditions is not possible with current MILES systems because MILES lasers will not penetrate obscurants associated with a dirty battlefield. The objective of this initiative is to develop advanced technology modules that can be integrated with MILES. They will enable real time target engagement and casualty/damage assessment on a dirty battlefield. This will enable MILES to satisfy 19K BNCOC training requirements heretofore not possible, e.g., tactical operations in NBC or night time environments. This initiative should result in various products within the next three years.
- Engagement Simulation Exercise Control (ESEC) - The training effectiveness of MILES exercises is greatly dependent upon command and control (C<sup>2</sup>) of engagement simulation exercises and the handling of engagement simulation data (e.g., their display and recall for use in exercise control, evaluation, and after action reviews). Though current ESEC initiatives are focused on these areas for purposes of permitting MILES exercises to be conducted at the battalion level, they have the potential of greatly enhancing the effectiveness of MILES exercises at the platoon level. Accomplishing this may enable MILES to satisfy additional 19K BNCOC training requirements. As is the case with the previously described enhanced MILES initiatives, ESEC, in some form, is expected to be available within the next three years.

Wide Field of View (FOV) Displays is a PM TRADE effort to satisfy current requirements of training systems to provide the wide fields of view in combat environments. Wide FOVs are necessary to train skills associated with target acquisition, engagements, and tactics because armor vehicle crew performance is dependent, to a great extent, on visual cues. When training skills, which collectively are required to operate or command a tank, these cues must be present if learning transfer (to a field environment) is to take place. This initiative will produce advanced visual displays required in any effective simulation training device. Therefore, any 19K BNCOC training requirement resulting in the need for wide FOV displays should consider this initiative.

Enhanced Three-Dimensional Targets (3DT) represents a current Army initiative to overcome the deficiencies of targets (e.g., two- as opposed to three-dimensional, stationary as opposed to moving, generic as opposed to real threat physical characteristics) currently used in live fire tank gunnery training. Current target deficiencies also limit or prohibit gunnery training with thermal sights on the M1 and M60A3 tanks. One product resulting from this initiative is a battery powered 2-D target system currently being fielded which overcomes many of these problems. However, the cost of this system may prove prohibitive.



Therefore, based upon the lessons learned from this device, efforts are currently underway to produce additional enhanced three-dimensional target systems that have a high probability of being fielded within the next three years. Such systems would prove beneficial in the 19K BNCOC program in areas such as friend or foe identification and other tactically as well as gunnery related training requirements.

The Videodisc Interpersonal Skills Training and Assessment (VISTA) system was originally developed to teach and assess junior officers leadership and counseling skills (e.g., performance counseling, EER counseling, "meeting the NCOs and Platoon"). Using computer-controlled interactive videodisc technology, VISTA placed the viewers/participants in realistic situations requiring them to apply interpersonal and leadership skills. Although the specific VISTA materials were developed for junior infantry officers, the leadership and counseling principles also apply to enlisted leaders (e.g., BNCOC students). This was recognized by ARI which applied the VISTA system (in its current configuration as a junior officer training system) to NCOs and enlisted personnel. Application of the VISTA to an enlisted population resulted in positive findings. Therefore, the VISTA system "as is" or modified to have an orientation to NCOs, could prove beneficial to the 19K BNCOC program.

The Hand-Held Tutor (HHT), developed by ARI, is a light weight, low cost, literally hand-held functional vocabulary and grammar tutor encompassing a state-of-the-art configuration of voice synthesis and display technologies (i.e., provides audio as textual output to users). The system was field tested using cannon repairmen (MOS 13B) with favorable results. The HHT has the potential of satisfying a variety of 19K BNCOC training requirements "as is" and could be modified to satisfy additional training requirements. The HHT differs from off-the-shelf, commercially available hand-held computers (discussed next) in that it was specifically designed and manufactured as a training device.

Several Hand-Held Computers are currently commercially available on an off-the-shelf basis. Their potential as training devices has recently been demonstrated in two programs. First, the Hewlett-Packard HP-41CV hand-held computer has been used to teach prerequisite mathematics to fire control system repairers (MOS 45G). Second, the Quasar/Panasonic RL-H1400 hand-held computer is currently being used to teach troubleshooting of electrical systems to light wheeled vehicle repairers (MOS 63B). Though courseware development has proved relatively costly for these systems, their application in satisfying 19K BNCOC program training requirements should be considered.

The Personalized Electronic Aid for Maintenance (PEAM) system is a microprocessor-based job aid designed to be collocated (because it is brief case size) with maintenance personnel as they perform maintenance duties. This system should be available within three years. The intent of the overall PEAM effort is to develop a generic job aid that could be applied to a variety of maintenance tasks. A current PEAM system is being developed to assist M1 tank maintenance personnel. The concept of microprocessor-based aids, collocated with users, has potential training applications. Therefore, the PEAM "as is," or modified may prove useful

to the 19K BNCOC program. In addition, the PEAM concept itself should be considered where 19K BNCOC training development requirements exist.

The Electronic Clipboard, being developed by the Jet Propulsion Laboratories (JPL) for ARI-POM, is a microprocessor-based, hand-held "clipboard" (literally) which will facilitate data collection during field exercises and post-exercise evaluation and feedback. The clipboard must be "loaded" with exercise-specific (e.g., STX, ARTEP) software from a "source" computer. The user then inputs performance-related data (resulting from prompt displays or menus generated by the clipboard) to the clipboard during the exercise. At the conclusion of an exercise, the clipboard data are "dumped" into the source computer which processes the data and provides feedback. It is anticipated that some version of the electronic clipboard (possibly related to armor operations) will be available within the next two years. Such a system could prove valuable to satisfying 19K BNCOC training requirements.

ARI is currently developing a Computer-Assisted Simulation of Tactical Voice Communications (SIMCOMM) for purposes of demonstrating the application and benefits of speech synthesis and voice recognition to Army applications. The system resulting from this effort will focus on "Call for Fire" procedures. In this context, the system's user will be presented with several target scenarios (i.e., single/multiple, stationary/moving, varying exposure times) using sophisticated computer imagery technology. Using TO&E radio equipment (interfaced to a Texas Instruments Professional Computer or TIPC), the user will communicate with a Fire Direction Center (FDC) following formal protocols associated with call for fire procedure. The FDC role will be simulated by the TIPC which will recognize the connected speech user transmissions (voice recognition) and respond with appropriate radio transmissions (speech synthesis using analysis/synthesis techniques). The indirect fire will then impact where requested and the user will be permitted to make subsequent adjustments. At the conclusion of one or more scenarios, the TIPC will provide hard copy user feedback (e.g., rounds used, ratio of rounds used to targets destroyed/damaged, number of targets presented/engaged/ destroyed/ damaged). The SIMCOMM is expected to be operational within the next fifteen months. Though designed to investigate/demonstrate the application and benefits of speech technology to Army applications SIMCOMM, with minor modifications, has the potential of satisfying several 19K BNCOC program training requirements. In addition, SIMCOMM represents perhaps the most sophisticated application of speech synthesis and voice recognition in the Army. Its success or failure should be monitored. If successful, the application of speech and voice recognition to any computer based training (CBT) system should be investigated and considered by 19K BNCOC training developers.

Vehicle Integrated Intelligence (VINT<sup>2</sup>) system is being developed to provide small unit commanders (e.g., tank commanders) with data derived from advances in high technology (e.g., remote and satellite sensor systems). These data could provide tank commanders with near real-time information regarding the location of friendly and enemy forces, terrain, and other aspects of tactical operations. TACOM (Tank and Automotive Command) is currently developing prototypical models of VINT<sup>2</sup> systems to be incorporated into the M1 tank, and ARI is involved

in the development of a VINT<sup>2</sup> research model. Though the TACOM effort is oriented towards production of an M1 operational system and the ARI effort is focused on an experimentation system/test bed, the interim and final products of both efforts (which will be available within three years) could prove beneficial to 19K BNCOC training requirements.

Applicability of Training Systems To 19K BNCOC Task Clusters.

Table 8 shows the applicability of the training systems described with specific 19K BNCOC task clusters. As the table shows, each training system is not applicable to all task clusters, and, where there is applicability, the degree of applicability varies. Three classifications of applicability have been used to indicate the degree to which a training system is applicable to a task cluster:

- Directly Applicable - This classification indicates that the training system is directly applicable to most, if not all, of the training requirements associated with the task cluster. This classification also implies that most of the tasks or skills addressed by the training system are applicable to the task cluster.
- Some Applicability - Here the classification implies that the training system addresses some skills or tasks associated with the task cluster's training requirements. It also implies the training system may address tasks or skills not associated with the task cluster's training requirements.

TABLE 8

## Applicability of Training Systems To 19K BNCOC Task Clusters

Training Systems	19K BNCOC Task Clusters										
	Intro Briefing	NCO Navigation Training	Land Navigation	NBC Defense	Military Comms	Mine Warfare	Tactics	Maneuver Warfare	Comms Warfare/ Guerrilla	Targeted Tactics/ Guerrilla	Comms Warfare/ Guerrilla
U-COFT											
I-COFT											
M-COFT											
COFT Driver Trainer											
C-COFT											
P-COFT											
Force-On-Force Trainer											
MK-1 Tank Gunnery Trainer											
Generic Armor Combat Unit Simulator											
Hostile Environment Simulator											
EW Simulators											
Target Acquisition and Identification Trainers											
SIMCAT System											
TRAX I											
Land Navigation Interactive Videodisc											
SAWE											
Thermal Sight Engagement Trainers											
ESEC											
Wide FOV Display											
Enhanced Three-Dimensional Targets (3DT)											
VISTA											
Hand-Held Tutor (HHT)											
Hand-Held Computers (HHC)											
PEAM											
Electronic Clipboard											
SIMCOMM											
VINT <sup>a</sup>											

<sup>a</sup>Includes On-Duty Remedial Training.

● Training system is directly applicable to training requirements associated with Task Cluster.

○ Training system has some applicability to Cluster (i.e., training system encompasses some skills not associated with Task Cluster and/or only a small number of training requirements associated with Task Cluster are addressed by the training system).

○ Training system's technologies and/or concept may be applicable to satisfying Task Cluster's training requirements.

- Technologically or Conceptually Applicable - This classification simply implies that the training system's technological architecture (e.g., speech synthesis/voice recognition or interactive videodisc) and/or concept (e.g., hand-held computer) may be applicable to satisfying a task cluster's training requirements.

Specifying the degree to which a training system is applicable to a task cluster is important for several reasons. First, only in a few cases was it found that a training system could satisfy all training requirements associated with a task cluster and that all the skills or tasks attained through that training system were related to the task cluster. Second, to prevent any misinterpretations, it was necessary to identify, as such, any training system that taught only some of the tasks associated with a task cluster, or additional tasks not associated with a cluster. Finally, the innovative technological architectures and concepts of the training systems, by themselves, could prove beneficial to the development of 19K BNCOC training. The absence of this classification scheme would have resulted in omission of potentially beneficial training systems/concepts and/or lead to gross misinterpretations of the information presented.

Although Table 8 is self-explanatory, some observations are noteworthy. Without exception, every training system identified had some degree of applicability to more than one task cluster. In some cases, this can be attributed to similarities between task clusters. However, in most instances, the degree of applicability is due to something else. This could be the result of the state-of-the-art technologies being incorporated into today's training systems which dramatically increases the overall training capabilities of the systems. In any case, it illustrates the current tendency away from part-task trainers or systems.

Another noteworthy observation is the fact that, to varying degrees, the majority of the training systems identified have some applicability to the Commander's Station/Tank Gunnery task cluster. In addition, overall, there is a higher degree of correlation with this task cluster than with any other. These facts may provide some indication of the current emphasis or focus of training systems. This does not imply that this focus or emphasis is misdirected. However, it is interesting to note those task clusters that have little applicability to the training systems identified. This fact demonstrates the importance of this effort to identify not only training systems which could be used in BNCOC, but to identify technologies and concepts which could be applied to BNCOC training requirements.

Another observation of interest is the number of and degree to which the training systems identified relate to task clusters of Tactics, Tactical Field Training Exercises, and STXs. Not too long ago, these types of task clusters did not even exist. We've come a long way since the days of the Operational Readiness Test and Army Training Test! This attests to the impact technology has made not only on the efficiency and effectiveness of training, but on our ability to address what are perhaps the Army's most critical training requirements.

Instructional Development Systems Considerations. Instructional development systems were previously defined as methodologies or procedures, available within the next three years, that are designed to serve as aids in the development of training. These methodologies and procedures could take the form of written materials or computer assisted systems. It is imperative that training developers are aware of instructional development systems for several reasons: (1) to facilitate standardization of approaches to training development; (2) to ensure standardization of training system hardware (both automated and nonautomated) and software (e.g., computer software, format/content of written materials, performance testing) to the degree possible; (3) to increase the effectiveness/efficiency of training; and (4) to expedite training development efforts and limit their costs.

At the top of any instructional development systems list should be the methodologies and procedures associated with the Systems Approach to Training (SAT) specified in TRADOC Regulation 350-7. In addition, given the recent and ongoing interest in the application of various technologies (discussed in the next section) and mini-/micro-computers to training requirements, there are also a multitude of other Army regulations (e.g., AR 18-1) with which the training developer should be thoroughly familiar before embarking on the development of a fully automated or computer assisted system such as those just described. However, these regulations have been around for quite a while and most training developers are aware of them. What is more important are the instructional development systems on the horizon.

Private industry, realizing the benefits of computer assisted, computer managed instruction (CAI, CBI, and CMI), has recently applied computer technology to the design of a computer assisted training or instructional development system. The first manifestation of this effort is the Hazeltine- developed MicroTICCIT system. The MicroTICCIT system is an integrated hardware, software, and courseware development system optimized for efficient production, delivery, and management of computer based training (CBT). Therefore, the MicroTICCIT system is not only an instructional development system, but also a vehicle that can be used for CBT, CAI, or CBI as well as CMI. Though MicroTICCIT is equally beneficial as a CBT, a CAI, a CBI, or a CMI system, it was decided to address it here under instructional development system considerations as opposed to training system considerations. However, its relevance as a training system should not be overlooked.

MicroTICCIT was designed to satisfy the recurring needs of the professional training developer, trainer, and training manager. Off-the-shelf hardware systems supporting from two to sixty-four work stations (for use by training developers and/or students) are available in both centralized and distributed network configurations. MicroTICCIT's authoring system, of great relevance to training developers, makes the production of high quality courseware (i.e., training) easy and efficient because the MicroTICCIT system tailors itself to the experience levels of the training developers who use it.

MicroTICCIT also provides an integrated computer managed instruction (CMI) system. Data are collected automatically during training and made available to instructors, training developers, and training administrators/ managers. Varying types and quantities of data may be collected, depending on the MicroTICCIT configuration and user requirements. Performance data can be used to produce a number of standard, as well as tailored, hard copy outputs. Reporting programs build and use a variety of summary files, which are then used to display or print desired outputs. These summary files constitute an additional database which may be used for summative performance data reporting.

Currently there are three MicroTICCIT configurations being developed. Besides having the common capabilities discussed above, each of these configurations has unique capabilities. The configurations are:

- MicroTICCIT I - The System I configuration was designed to satisfy needs associated with the delivery and editing of existing courseware and for small-scale development of new courseware. This system will support up to ten MicroTICCIT work stations, each of which can be used for student, instructor, or training development functions.
- MicroTICCIT II - The System II configuration is designed to optimize courseware development and delivery for medium-scaled, computer based training efforts. This system can support up to forty MicroTICCIT work stations each of which can be used to satisfy student, instructor, or training development functions.
- MicroTICCIT III - The System III provides a family of systems designed to optimize training development and delivery of large-scale, computer based training efforts. Each configuration can support up to sixty- four work stations used for either student, training developer, or instructor functions.

ARI is currently in the process of purchasing MicroTICCIT II to investigate its utility in instructional development and in training delivery. The current intent is a limited application of these systems to the 19K BNCOC program. The other armed services are investigating similar MicroTICCIT applications. For these reasons, they should be considered by 19K BNCOC training developers with respect to each of the MicroTICCIT applications (i.e., instructional development, delivery and CMI) being investigated by the ARI. With respect to the specific training requirements of 19K BNCOC task clusters that could be satisfied by MicroTICCIT systems, the systems should be considered equally applicable to all task clusters.

Technology Considerations. When 19K BNCOC training developers are faced with the requirement to develop training, they need to be aware of the technologies currently being applied to training. In most cases, the Army training developer's knowledge of such technologies is limited. In the rare instances where training developers possess such knowledge, more often than not it was obtained as a result of the developer's own

initiatives; the knowledge did not result from Army training nor did it exist in a reference document. To apply a systems approach to the development of training for tank commanders, it is necessary to identify these technologies. Doing so assures that these technologies will be considered.

There are four technologies that the 19K BNCOC training developer should especially be aware of: computer technology in general, interactive videodisc technology, speech technology, and artificial intelligence (AI). One might interpret this grouping as a mix of apples and oranges, e.g., speech and AI technologies are appropriately interpreted more as "technologies" than are interactive videodiscs. Additionally, one could appropriately interpret AI and speech as specific technologies, whereas computer technology is more generic; these interpretations would be accurate. However, to properly assess the impact of technologies on training development as it relates to 19K BNCOC training developers, apples and oranges must be mixed, i.e., an impact assessment of technology is best discussed in terms of these categorizations. Each will be addressed individually.

Computer Technology. Computer technology significantly impacts today's military training as well as the tactical systems soldiers will operate on the battlefield. It will undoubtedly play an even greater role in these areas in years to come. There are now more than 250 automated tactical systems, and an unknown number of automated training systems currently fielded by the Army. This proliferation of computer technology in today's Army will continue in a variety of applications, including training. Computer assisted, computer based, and computer managed instruction (CAI, CBI, and CMI) are common terms in the Army's training community. Given these facts, it is imperative that any Army training developer, including the 19K BNCOC training developer, be "instructional" computer literate. This implies that the training developer not only possess a basic knowledge of how computers work (i.e., computer literacy) but, in addition, how they relate to and can benefit training (i.e., "instructional" computer literacy). The training developer must be aware of what a computer can do and must be capable of linking training requirements with computer technology. Without this understanding, the full potential of computers, as they relate to training, may never be realized.<sup>1</sup>

Interactive Videodiscs. Interactive videodisc is an instructional delivery system which combines the techniques of computer assisted instruction and instructional television. Normally, interactive videodisc systems integrate a microcomputer, videodisc unit, a color television and/or monitor, and operating software. Interactive videodisc technology permits presentations of people, events, and problems in

---

<sup>1</sup>Perhaps some of the technologies addressed in this document (e.g., interactive videodisc, and voice) could be applied to the development of a generic "instructional" computer literacy system for Army training developers.



a realistic form, through video. The technology then permits the trainee to "select" answers or actions which result in something happening, such as people doing things or events occurring, based on what the trainee selected (i.e., an "answer" or action). This interactivity is possible because the system can randomly access distinct "pieces" of video within seconds and "play" it in the form of a video output. Because interactive videodisc technology does not burden the trainee with textual material, it represents a beneficial technology which should be considered by all training developers. Interactive videodisc technology exists today and already has been used in a number of training research programs. One of the few training programs in which interactive videodisc technology is actually being applied is the 19K BNCOC program where a land navigation videodisc is currently being produced (discussed previously).

Speech Synthesis/Voice Recognition. Speech technology is one of the more promising advanced computer technology initiatives. Speech technology really involves two "subtechnologies": speech synthesis and voice recognition.

Speech synthesis permits storage of digitized speech (up to eight hours on a single floppy disc in some systems such as the TIPC) enabling a multitude of possible speech outputs. With the innovation of analysis/ synthesis speech systems, speech output no longer needs to sound "robotic" as it did when synthesis-by-rule speech systems were commonly used. Analysis/synthesis systems provide natural-sounding speech outputs.

Voice recognition is a far more complex technology and is normally placed into two categories: isolated word recognition, where utterances are isolated and treated as a single word requiring pauses between utterances for discrimination; and connected speech where continuous strings of words are recognized without pauses.

Speech technology has the potential for widespread application and beneficial payoff in Army training systems. It can enhance the effectiveness of CAI and CBI systems by permitting the trainee to communicate with the computer in the manner he is most familiar with--speech. This can eliminate the distracting and often disruptive artifacts of most CAI, CBI systems which force trainees to cope with typing skills (i.e., a keyboard) and artificial languages (e.g., commands). In addition, speech technology can lessen the burden on the instructor as he attempts to transfer subject matter to slow learners (e.g., repetition of materials and retraining to compensate for retention difficulties). With regard to simulators used to train team interactive skills, speech technology can decrease the need to populate such systems (e.g., SIMCAT) with real people. Here, speech technology can role play team members not present for training or perform as external command and control. Speech technology therefore has the potential of two major payoffs: (1) enhanced effectiveness of training systems, and (2) substantial reduction of manpower requirements. This technology is available today, continues to be refined, and is currently being employed in training systems, e.g., SIMCAT and SIMCOMM (discussed previously).

Artificial Intelligence (AI). AI has been and is the focus of much interest and effort. In a restricted sense, AI can be defined as a set of processes which enhance the effectiveness of digital computers through improved programming techniques (e.g., logic paths, sensing). The intent of these processes is to enable a machine (computer) to improve its own operations through learning, adapting, reasoning, self-correction, and automatic improvement. These descriptors are normally used to describe human capabilities. However, with the advent of mass storage, large memory, rapid processing, and sophisticated software, these capabilities can be "created" within a computer.

As an emerging technology, AI is often referred to as "knowledge based," "expert systems," or "expert rule-based" (ERB) systems--perhaps more appropriate descriptors given the current state-of-the-art of AI. Indications are that the application of AI or expert systems to Army training would be productive in terms of manpower economy and training system efficiency. Potential benefits include:

- Training Development - Using expert systems as training development tools, the time required to develop training could be shortened considerably. MicroTICCIT, though not regarded as an AI or expert system, is illustrative of this potential.
- Surrogate Instructors - To offset the impact of a decreasing expert instructor force in the Army, knowledge-based expert training systems could serve as surrogate instructors. These systems would emulate the best characteristics of expert instructors, augment the less experienced instructor force, always be available to "instruct," and easily replicated/duplicated, thereby giving every command (regardless of location) access to and the benefit of "expert instructors."
- Surrogate Crew/Unit Members - Most crew-served weapon system training systems (e.g., the Conduct of Fire Trainers or COFT previously discussed), require that all trainee positions (e.g., TC, gunner, loader, driver) be manned. Likewise, most battle simulations (e.g., SIMCAT, discussed previously) require that all unit members be present (e.g., platoon leader, platoon sergeant, and two TCs) for the system to operate. Expert systems or AI could be applied to such systems for the purpose of simulating or role playing "missing" unit members.

Exploitation of AI has the potential of shortening training development time, and increasing the efficiency of today's training through surrogate instructors and surrogate crew/unit members. In addition, applying AI to diagnostic, interactive, tactical battle simulations will enhance fidelity and, thereby, training effectiveness. AI has a long way to go before it lives up to its definitions. However, in its embryonic forms (e.g., expert systems, or intelligent computer aided instruction (ICAI)), AI does have the potential of proving extremely beneficial to Army training. It is in these forms, which are currently

being applied to training, that AI should be considered by training developers. In addition, training developers should keep abreast of AI developments. AI may live up to its definition sooner than expected.

The TRIADS Initiative. Although neither a technology nor a training system, another training effort that training developers should also be aware of is a recent joint services initiative known as TRAIDS (not an acronym). The TRIADS program is a joint-services effort to develop a family of hardware and software in support of computer based instruction. This program will result in the establishment of operational Military CBI Centers. Functions of these centers will include: (1) demonstrating CBI capabilities; (2) identifying steps needed to obtain funding; (3) actually performing or assisting in system definition studies; and (4) assisting in system acquisition, development, implementation, and maintenance. When established, these centers could provide invaluable assistance to training developers. It is unknown at this time when these centers will be operational. However, it is feasible that model centers will be operational within the time frame focused upon in this document, i.e., within three years.

#### 19K BNCOC Students

With the proliferation of sophisticated unit and institutional training systems throughout the Army, it is important that each 19K BNCOC student be familiar with such systems and their associated technologies. As a 19K, the student will interact with a multitude of training systems and technologies in three capacities, i.e., as a 19K BNCOC student and, after being assigned to a unit, as a unit training student as well as unit trainer. As a BNCOC student, in order to learn, he must be familiar with the systems. Once assigned to a unit, he will also be a student of unit training and should be familiar with unit training systems not used in institutional training. As a trainer in a unit, he must be familiar with whatever systems he is to use to function effectively as a trainer.

The 19K will interact with some of the training systems identified (e.g., enhanced MILES) in all three capacities (BNCOC student, unit trainer, and unit training student). In other cases, he may interact with an identified training system in only a single capacity (e.g., his experience with the I-COFT would be restricted to his experience as a 19K BNCOC or ANCO student).

The 19K's specific training system familiarity requirements in any capacity will vary depending on which systems are adopted or applied in institutional training (e.g., 19K BNCOC) and unit training. Therefore, his familiarity requirements can be stated only in general terms: (1) as a 19K BNCOC student, he must be familiar with any of the training systems identified that are incorporated into the 19K BNCOC training program; and (2) once assigned to a unit, the 19K must be familiar with any training system that has been adopted or implemented to satisfy unit training requirements.

With respect to technology knowledge requirements, it is imperative the 19K BNCOC student be "instructional" computer literate (i.e., possess an understanding of CAI, CBI, CMI, and ICAI), and have an appreciation for and elementary understanding of AI, speech technology, and interactive videodiscs. This knowledge will benefit him not only as a 19K BNCOC student, unit trainer, and unit training student, but as a tank commander. General and instructional computer literacy coupled with a knowledge of the previously discussed technologies will enable him to better understand one of the most sophisticated, technologically advanced weapon systems in the world--the M1 Abrams tank which he commands.

#### 19K BNCOC Instructors

With respect to the impact of training systems and technologies on BNCOC instructors, two areas must be addressed. First, the training systems the instructor should be familiar with must be identified. Second, generic technological orientations the instructors should possess must be identified.

The training systems about which the instructor should have some knowledge would include any of the training systems previously identified that are incorporated into the 19K BNCOC program. As was the case with the 19K BNCOC student, it is not possible, at this time, to state with any certainty which of these systems will be incorporated into the BNCOC program. However, the training systems identified in the earlier discussion represent a comprehensive list of the systems that could be incorporated into the program.

The 19K BNCOC instructor's technology knowledge requirements would include all technologies identified as training developer knowledge requirements. Especially important among these is that the 19K BNCOC instructor must be computer literate as well as possess some understanding of CAI, CBI, CMI, and ICAI, i.e., be "instructional" computer literate.

#### Summary

The rapid advancement of technologies and their applications to microprocessors continue at a phenomenal rate, with changes occurring almost daily. Combined, these advancements have permitted the affordable introduction of fidelity, effectiveness, and efficiency to training systems to a degree heretofore unprecedented. Seizing upon the opportunities represented by this phenomenon, the U.S. Army is vigorously exploiting microprocessors and their associated technologies in a variety of training applications filling many training gaps which historically were considered "unsolvable." These Army initiatives have resulted in a proliferation of CAI, CBI, CBT, CMI, and ICAI training systems. This is expected not only to continue, but to gain momentum.

Although this flurry of technological advancements and consequential Army initiatives has proved tremendously beneficial, it has also resulted in some problems. Paramount among these problems is the impact of the proliferation of sophisticated training systems on training developers, instructors, and students of Army training. The objective of this effort was to assess and compensate for these impacts as they relate to the 19K BNCOC training program. To accomplish this, training systems and technologies were identified that should be considered in applying the systems approach to training tank commanders. Specifically, the impact of the training systems and technologies identified on 19K BNCOC training developers, instructors, and students was ascertained.

The proliferation of sophisticated training systems and their associated technologies was found to have its greatest impact on 19K BNCOC training developers. Twenty-seven training systems were identified that should be considered by the 19K BNCOC training developer. The applicability of the identified training systems to specific 19K BNCOC task clusters was also ascertained and presented. Though the training systems identified are currently at various stages of development, ranging from conceptualization to actual production, all are expected to be available within the next three years. As such, they have the potential for satisfying one or more 19K BNCOC training requirements. In addition, four technologies (i.e., computer technology in general, interactive videodiscs, speech synthesis/voice recognition, and artificial intelligence) were identified. They should be considered by the 19K BNCOC training developer in instances where training requirements cannot be satisfied by existing/ near-future training systems and where training must be developed from scratch. In addition, the emergence of systems designed specifically for the purpose of facilitating the development of instruction was identified. These instructional development systems will prove tremendously beneficial to all training developers, and knowledge of them may become a prerequisite for assignment as an Army training developer.

Considering the current as well as potential use of a wide variety of sophisticated training systems in the 19K BNCOC program, it was also concluded that the proliferation of such systems also had an impact on the BNCOC instructor. Specifically, the BNCOC instructor needs to know how to operate the training systems that are incorporated into the 19K BNCOC program, and he requires some knowledge of the technologies involved. Likewise, the 19K BNCOC student requires familiarity with the training systems that will be employed in the BNCOC program. In addition, the 19K BNCOC student must become familiar with the training systems he will be expected to use as both a student and a trainer once he is assigned to a unit.

One overriding concern resulting from this effort centered on the requirement that 19K BNCOC training developers, instructors, and students must be, to varying degrees, "instructional" computer literate. Instructional computer literacy requires a combination of both computer literacy and knowledge of the variety of ways computer technology can be applied to satisfy training requirements. This is especially critical to training developers where it is of absolute necessity if the full

benefits afforded by computer technology are to be realized. With respect to BNCOC instructors and students, instructional computer literacy is required to overcome the anxieties and inhibitions often associated with the introduction of technology in an application, i.e., user acceptance. Not attending to this problem could seriously hinder the potential benefits technologies have to offer training. Like it or not, BNCOC training developers, instructors, and students must, to varying degrees, themselves become literally instructional technologists.

## REFERENCES

- ARTEP 71-2 (1981). Army training and evaluation program for mechanized infantry/tank task force. Washington, DC: Department of the Army.
- Boldovici, J.A., Kraemer, R.E., Reeves, J.R. & Healy, R.D. (1975). Critical incidents as reported by veterans of armored combat. (Final Report). Alexandria, VA: Human Resources Research Organization.
- Common/shared tasks selected for training, MOS 19K10-40 (M1 armor crewman) (1983). Fort Knox, KY: United States Army Armor School, September.
- Drucker, E.H. & O'Brien, R.E. (1981) Mission-based analysis of armor training requirements. (Final Report FR-MTRD(KY)-81-2). Alexandria, VA: Human Resources Research Organization.
- FM 17-12-1 (Draft) (1982). Tank gunnery M1. Fort Knox, KY: United States Army Armor School.
- FM 17-12-7 (Draft) (1984). Tank gunnery devices. Fort Knox, KY: United States Army Armor School.
- FM 17-15 (Test) (1983). The division 86 tank platoon. Washington, DC: Department of the Army.
- FM 17-19K1/2 (1983). Soldier's manual MOS 19K, M1 Abrams armor crewman, skill levels 1/2. Washington, DC: Department of the Army.
- FM 19-19K3 (1983). Soldier's manual MOS 19K, M1 Abrams armor crewman, skill level 3. Washington, DC: Department of the Army.
- FM 17-19K4 (1983). Soldier's manual MOS 19K, M1 Abrams armor crewman (platoon sergeant) skill level 4. Washington, DC: Department of the Army.
- FM 21-2 (1982). Soldier's manual of common tasks, skill level 1. Washington, DC: Department of the Army.
- FM 21-3 (1981). Soldier's manual of common tasks, skill levels 2, 3, and 4. Washington, DC: Department of the Army.
- 1980 catalog: training aid devices and graphics (1980). Fort Knox, KY: Training and Audiovisual Support Center.

Program of instruction: Basic noncommissioned officer course (BNCOC) 19K  
M1 Abrams (June 1983). Fort Knox, KY: United States Army Armor  
School.

TC 17-15-1 (Draft) (1983). Division 86 tank platoon mission training  
plan. Fort Knox, KY: United States Army Armor School.

TRADOC Pamphlet 310-8 (1981). Collective front-end analysis for  
development of the Army training and evaluation program (ARTEP).  
Fort Monroe, VA: United States Army Training and Doctrine Command.

TRADOC Regulation 350-7 (1982). A systems approach to training. Fort  
Monroe, VA: United States Army Training and Doctrine Command.

TRADOC Pamphlet 351-4 (1979). Job and task analysis handbook. Fort  
Monroe, VA: United States Army Training and Doctrine Command.

TT 71-1/2 (1982). The Abrams battalion, division 86 (volumes I and II).  
Fort Knox, KY: United States Army Armor School.

Video tape catalog (1983). Fort Knox, KY: Training and Audiovisual  
Support Center.

Vineberg, R. & Joyner, J.N. (1980). Instructional system development  
(ISD) in the armed services: methodology and application.  
(Technical Report TR 80-1). Alexandria, VA: Human Resources  
Research Organization.

END